AVIATION

The Oldest American Aeronautical Magazine

FEBRUARY 16, 1929 Issued Weekly PRICE 20 CENTS

Captain Hawks' record breaking "Wasp" powered Lockheed "Air Express"

VOLUME XXVI

NUMBER 7

Special Features

The New York Show

Accidents and Their Causes

Adaptation of the Paulin System of Altimeters

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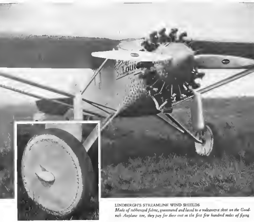
Men *and* Materials



LINDBERGH'S STREAMLINE WIND SHIELDS
Made of rubberized fabric, grommeted and laced to a vulcanized skirt on the Goodrich Airplane tire, they pay for their cost in the first few hundred miles of flying

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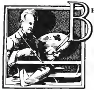

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AVIATION

The Oldest American Aeronautical Magazine

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AVIATION

The Oldest American Aeronautical Magazine

Vol. XXVI FEBRUARY 16, 1929 No. 7

Admiral Moffet

NO one has ever been satisfied with aircraft development in the Navy The old line admirals have always felt that it was progressing too fast while the rabid aircraft advocates have loudly proclaimed that battleships were as obsolete as the dinosaurs and might as well be scrapped

While the windy war was being waged the aeronautics branch of the Navy made real and steady progress Airplanes were placed on every battleship, carriers were developed, planes of constantly greater power were built, and, what is more, put to practical use More flying has been done each succeeding year and even the most reactionary are forced to admit that the airplane is an essential part of the fleet Personally no aeronautical enthusiast is satisfied with the state of affairs, but looking at the matter broadly, American Naval Aviation has progressed steadily and thoroughly during the past eight years, and is in certain respects ahead of the navies of other countries

For eight years now the guidance of Naval Aviation has been in the hands of Rear Admiral Moffet. His task has not been an easy one for he had to overcome the passive and, at times, active resistance of one of the most powerful and thoroughly disciplined organizations in the world, the heads of which were strongly prejudiced against the rapid development of aviation He has been faced with the fact that the operation of aircraft from the open sea was an extremely difficult matter and yet he has been limited in the amount of development work which he could carry on However, in face of really great difficulties substantial progress has been made

The Admiral's second term expires this March, and it is the general precedent that two terms in such an office is sufficient, but in view of his splendid service in the past it is to be hoped that an exception will be made, for there are few men who possess the experience, energy and tact which have made possible the results achieved thus far

Aeronautical Stocks

MAN can move from the antarctic to the equator and adjust himself to the varied conditions with remarkable ease When, however, he must adjust himself to radical and fundamental changes in the business in which he is engaged he has a much more difficult time of it. The refinancing of the aeronautical industry which has been going on at such a rapid pace during the past year has meant a complete readjustment of the mental attitude of almost everyone connected with the business Much of the financing which has been done is on a scale which is greater than that which even the most optimistic members of the industry could imagine a few years ago. It is only natural that many of those who have been actively in the aviation business for many years should rub their eyes and pinch themselves and occasionally wonder whether what they see and hear is really true.

There is no doubt that the public is in an extreme stage of enthusiasm about aernoautic stocks and that many of them have been bid up to a point which is way beyond their past or present value, and which discounts far ahead the growth which the companies may make in the future. It is also true that the ease of obtaining money has led to the financing of many companies and schemes which are probably either unsound or not sufficiently well worked out Such a condition is always true in any industry which is undergoing a rapid growth but the aeronautic industry seems to be growing unusually fast

There is bound to be some reaction and it is very hard for those who have seen the slow and struggling growth of the industry to realize that the present boom will carry the industry to heights which have never been reached before. There will be some reaction but the aeronautical game as it has been known up until now will never again reappear. Much of the money which is being put in the industry is being placed through very substantial banking concerns and this is certain to have a stabilizing influence Even though the public ceases its frenzied bidding up of aeronautical stocks there will be ample financial reserves to allow the more soundly organized companies to carry on

Clean Cockpits

THE cockpits of open planes are rather mean places to clean To get the dust out of the bottom of them one must more or less stand on one's hand As a result the average cockpit, even in a plane which is outwardly kept very clean, is allowed to clean itself. The process is very simple The pilot puts his machine into a steep side slip or into a spin and the resulting drafts act much in the manner of a vacuum cleaner This method is especially effective when the passenger is a novice who has had little experience in the air The novice instinctively draws in his breath as soon as the plane goes into a steep side slip and thus absorbs a large part of the dust which has been left on the floor. After several experiences of this kind, the passenger learns not to draw in his breath. He also finds out whether his goggles fit as they should Old-time pilots are accustomed to this dust and dirt storm but the average passenger who is getting a demonstration really does not like it It is suggested that cockpits be kept clean and that to make this easier, manufacturers put zippers on a door on the side and bottom of the cockpit so that it can be cleaned without going through the contorions now necessary.

Adaptation *of the* Paulin System *to* Altimeters

By Charles F. McReynolds

WHAT is believed to be a promising development in aerial navigation instruments is the application of the Paulin System to aircraft altimeters. The Paulin System, patented in 1919 by G. Paulin, the Swedish inventor, is said to involve certain improvements in aneroid instruments, and altimeters and barometers using this principle have gained wide acceptance because of their accuracy and dependability.

Until recently, the Johansson Company of Sweden, maker of the famous Johansson precision gauges, was the only manufacturer in the world licensed to produce Paulin System instruments. In 1926 the American Paulin System, Inc., was licensed to manufacture and sell Paulin System instruments in the entire western hemisphere, including North, Central, and South America, China and Japan. This company, headed by H. E. Linden, a western engineer and instrument expert, has assembled an organization of instrument technicians, and after months of preparation is now ready to start production on the aerial altimeter in Los Angeles. Every effort is being made to assure production in quantities sufficient to meet the American demand.

By the use of the Paulin System aerial altimeter it is possible to determine the true altitude above sea level at any desired moment whether the plane be climbing or diving and with an error usually not exceeding 10 ft. Another feature is the extremely sensitive "tendency pointer" which indicates at once any departure from a given altitude and makes it possible to fly at a predetermined level with ease and accuracy.

In appearance the Paulin System aerial altimeter resembles most others, having a large circular scale which is particularly easy to read. A special shock absorbing device built into the case allows the instrument to be mounted without additional cushioning.

Instead of a constant reading pointer which tells the approximate altitude at all times, the Paulin altimeter has a manually operated "setting pointer" by which the exact altitude may be determined at any desired moment. This pointer is set by means of a large knob at the center of the dial. This knob is large enough to permit quick, accurate settings even when the fingers are protected by heavy gloves. The sensitive tendency pointer projects through a horizontal slot at the top of the dial. When the setting pointer has been set to the altitude of the instrument, the tendency pointer will be in the zero position at the center of the scale.

Wishing to know his altitude at any time the pilot glances up at the tendency pointer, moves the setting knob until the tendency pointer is at zero, glances at the setting pointer and reads the altitude which has just been determinded. The setting pointer will remain exactly where set until again moved by the operator. If the pilot wishes to fly at any particular altitude he turns the setting knob until the setting pointer indicates the desired level on the altitude scale, and then either gains or looses altitude as may be necessary to bring the tendency pointer again to the zero position.

To continue flying at this level it is only necessary to observe the tendency pointer, which will plainly indicate a deviation of 10 ft. or more in altitude. If the plane climbs above the altitude shown, the tendency pointer moves to the right or minus side of the slot scale, indicating that altitude must be subtracted; and if the plane drops below the altitude for which the instrument is set the tendency pointer moves to the left, or plus side of the scale, indicating that more altitude must be gained in order to fly the predetermined course.

A—evacuated metal box. B—staff connecting diaphragm to beam arm. C—calibrated steel spring for balancing diaphragm. D—screw by means of which tension of spring C is varied. E—altitude scale. F—tendency pointer which indicates balance. G—stops limiting movement of diaphragm and beam. H—setting knob by which system is balanced.

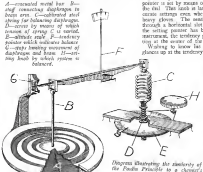


Diagram illustrating the similarity of the Paulin Principle to a chemist's scale of the beam balance type

Above—The Fairchild plane in which the flight tests were made. Left to right, Leon T. Ehel, Lieut. R. D. Kelly, H. E. Linden, H. L. Blackman and Fred Franklin. Below—the Paulin Altimeter.

Since barometric pressure will often change and the plane will be flown from fields of varying altitudes, a zero adjustment has been provided which permits the setting pointer to be set at zero for any field or barometric pressure. Adjustment is accomplished by turning a small knurled stud on the setting knob, which in turn moves the setting pointer with relation to the setting knob. Before taking off the pilot rotates the setting knob until the tendency pointer is in the zero position, then if the setting pointer does not indicate zero on the altitude scale he may turn the stud on the setting knob until the setting pointer does indicate zero. Thereafter the instrument will give readings of true altitude above that field during the flight, changes in barometric pressure rarely being sufficient to cause a serious error during a short flight.

Although the tendency pointer is extremely sensitive, it is so damped that engine or instrument board vibration has practically no effect upon it. In approaching a predetermined altitude the tendency pointer will start moving toward the zero position when still about 300 ft. from the desired level, and will cross the zero line with an easily perceptible motion when this level is reached. It is this movement of the tendency pointer that makes the operation of flying at a given altitude so simple.

As in the case of all aneroid instruments, the Paulin system altimeter employs an evacuated metal box fitted with a sensitive diaphragm which responds to slight changes in atmospheric pressure. The movement of the diaphragm is multiplied many times and transmitted to the indicating hand on the face of the instrument. Bearings in the mechanism linking the diaphragm and the indicating hand are eliminated in this altimeter. According to the manufacturer this eliminates error due to lag, hysteresis and other causes.

The sensitivity and accuracy of this instrument is gained chiefly by the use of the null or zero gauging principle, all readings being made when the diaphragm has been brought to normal position. Stops built into the instrument limit the maximum diaphragm movement to approximately .001 in. in either direction, thus protecting both diaphragm and tendency pointer from injury due to sudden extreme changes of atmospheric pressure.

In principle the Paulin instrument is analogous to the beam balance of the chemist, in which an unknown weight is placed in one pan, known weights are placed in an opposite pan until the balance is perfect ,and a tendency pointer on the beam indicates this point of exact balance or any slight departure from it.

The Paulin System altimeter balances a calibrated steel spring against the unknown pressure of the atmosphere upon the metallic box to which the spring is connected. The tension in this spring may be varied by rotating the setting knob to which is attached setting pointer on the altitude scale. When an exact balance is obtained the tension in the spring is equivalent to the air pressure on the evacuated chamber. The tendency pointer indicates this perfect balance by moving to the zero position, and the setting pointer then indicates the tension in the spring in terms of exact altitude. Another feature of the Paulin System is that it permits the diaphragm to balance against its spring unhampered by any other duties except the infinitesmal amount of energy required to move the tendency pointer. An ingenious arrangement of simple metal bands connects a cradle on the diaphragm with the tendency pointer in such a way that all bearings and friction are eliminated and yet the diaphragm movement is multiplied in movement of the pointer by ratio of 370 to one.

When an altitude has been set on the Paulin altimeter, higher than the altitude of the instrument, the turning

of the setting pointer will slightly relieve the tnesion on the spring within the instrument and thus permit the metallic diaphragm to move downward under the pressure of the atmosphere through a distance of .001 in. until it rests against the lower diaphragm stop. This movement of the diaphragm through a distance of .001 in. will in turn have moved the tendency pointer from zero to plus, indicating that the instrument is below the altitude which has been set. As the plane climbs and approaches the desired altitude the atmospheric pressure will grow less until it just balances the tension of the spring, at which point the diaphragm will have moved up to a point midway between the upper and lower stops and the system will be in perfect equilibrim. This will be shown by the position of the tendency pointer having moved from plus to zero on the scale, through a distance of ⅜ in.

It is readily apparent that this indicating of a plane's position with regard to an altitude at which it is desired to fly, is an exact analogy with the direction indication of an earth inductor compass. A pilot may, by using the earth inductor compass and a Paulin System aerial altimeter, fly exactly in a predetermined direction and constantly at a predetermined altitude.

In May of 1927 at McCook Field, Lieuts. Albert F. Hegenberger and Raymond D. Kelly, conducted tests on the Paulin System altimeter for the U. S. Army Air Corps.

Army Orders Instruments

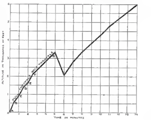
The Army Air Corps has since ordered several of the Paulin altimeters for installation in photographic and bombardment planes. Later in 1927 tests were made by several aerial photographic concerns which resulted in the adoption of the instrument by each of these companies.

During a series of tests recently made at Mines Field, Los Angeles, to determine certain climb characteristics of the Lockhead Vega monoplane, Lieut. Raymond D. Kelly consistently obtained readings with the Paulin altimeter that checked within five feet. He was also able to determine the slip stream effect within the cabin, finding it equal to a 30-ft. gain in altitude. Much new and valuable data was gained on the climb performance of Lockheed planes and both Allan Loughead, the manufacturer, and Gerald Vultee, chief engineer of the Lockheed organization, endorsed the instrument for flight test work.

In December, 1928, Fred L. Bronson, designer of the Maximum Safety airplane, used the altimeter during a climb test conducted at the Long Beach Municipal Airport. By setting the instrument for zero at the field and then setting the hand for 1000 ft. he was able to time the plane's climb to 1000 ft. by snapping his stop watch at the moment of take off and again when the tendency pointer passed the zero position. On descending he set the hand at zero altitude and found that the tendency pointer crossed the zero position just as the plane's landing gear touched the runway.

The writer was able to measure the difference in altitude of a desk top and the office floor by using a magnifying glass to read the Paulin instrument. He also found that while riding up and down in an elevator it was possible to measure accurately the height of a 130-ft. building and also to measure the distance between any two floors, the altimeter being carried in one hand while adjustments were performed with the other.

According to the manufacturer, various tests have proved the value of this new altimeter for all types of flying where exact knowledge of altitudes is required. Particular uses are indicated in connection with the climb and dive testing of aircraft, the operation of air transport planes in obscure weather, and the making of aerial surveys. In connection with the use of Paulin Altimeters for aerial photography, a test made recently showed that



Graph showing the rate of climb of the Fairchild monoplane used in the tests on the Type A-2 Paulin altimeter. The rates of climb in ft. per min. are A-B, 1100; B-C, 800; C-D, 960; D-E, 440; E-F, 900; F-G, 500. The total load carried was 1575 lb. Note—The irregularity in the curve between D and E was due to the fact that the pilot pulled the stick too far back.

the pilot could stay within 25 ft. of any desired level with the greatest ease, thus increasing the accuracy of his maps and reducing the expense of their production from the mosaic of individual negatives.

Production methods in the American Paulin System factory at Los Angeles are on a par with the finest instrument factories of the world. Although processes used in the manufacture of these delicate instruments are too involved for a detailed discussion there are one or two features of the work that indicate the extreme care taken throughout.

The steel springs, used to balance the diaphragm within the instrument, are allowed to age for a long period after their manufacture before they are calibrated to determine the exact tension. This permits any initial stress set up by forming the spring to adjust itself and leave the metal in its permanent form at the time of calibration.

Another process developed for sealing the evacuated metal boxes against which the air pressure is exerted within the instrument, permits them to be sealed in lots of 200 within a large bell jar which is evacuated. This means that instead of subjecting each box to the possible variations incident to exhausting and hermetically sealing them one at a time, that every one of the 200 will match every other one.

As rapidly as facilities can be provided other instruments will be placed under production by the American Paulin Co. These include in addition to aircraft altimeters, ground altimeters, barometers, pressure gauges, manometers, aircraft instruments, tensionometers (for blood pressure measurement), tank gauges and in general, any instrument which must measure very low pressures with extreme accuracy.

Officials of the American Paulin System Inc., are H. E. Linden, president and general manager; G. K. Calhoun, technical director; and Lieut. Raymond D. Kelly, aeronautical instrument engineer.

How Do We Sell Three Planes Every Day?

By J. Don Alexander
President, Alexander Aircraft Co.

HOW do we sell three airplanes every day? I can put the answer in one word—co-operation.

Our whole sales force is organized on co-operative lines. We can prosper only as do our dealers and distributors. If they prosper, so do we. The factory is interested with the men who handle its product and we have made recognition of the joint interest the key-note of our sales policy. We have done everything possible to work out and develop close and effective teamwork between the headquarters organization and the sales force.

All parties concerned in the enterprise have certain rights, and it is our idea that those rights should be protected. Our distributors, for instance, absolutely control the territories to which they hold assignment. No matter how, or by whom, one of our airplanes is sold within a distributor's territory, that distributor gets credit for it. Even if he had never heard of the buyer, and the sale should be made from the factory direct—which it would not—he would get credit for it.

Contract is an Asset

When a distributor signs up with us, he assumes a definite responsibility, for to his dealers he is going to be the company itself. He gets a contract from us that is a real asset, and he owes it to us to use that asset so that we shall both benefit.

It is our aim to retain every distributor permanently. We pick our men very carefully and we never make a change on snap judgment. Our distributors know this and, consequently, they are willing to exert themselves in building up a business for themselves, a business in whose growth we are vitally interested. We do not ask any distributor to sign up for any definite number of planes.

We have not so much to do with the dealers as we have with our distributors, for the distributor organizes and controls his dealers. However, we do help them directly. We have from three to five "flying men" always in the field, working with the dealers individually, who show them how to close sales, how to advertise, how to make the most of their opportunities and who educate them on our co-operative sales plan.

We do insist on a high degree of serviee to the buyer. No sale is ever complete with us until the owner of the plane is either killed while riding in some dangerous automobile, or ceases to use the airplane from some other cause. This makes a great deal of difference in meeting competition. No purchaser of one of our planes will ever be able to say that he owns an "orphan," for the factory will stand behind every plane it builds; and we will insist that dealers and distributors give service to everyone they sell as long as the planes remain in use.

We give our distributors and dealers considerable advertising assistance, though we do not do any direct, local, advertising for any one of them. We have a public relations department of five persons, which prepares advertising copy, tells dealer and distributor how to use newspaper advertising or billboards, and supervises production of certain motion picture films that have helped a great deal in popularizing the plane.

We publish the *Aircrafter*, a little magazine that has done more than anything else to promote airplane sales for us. We issue from 15,000 to 20,000 copies of this publication every month and the mailing list is boiled down, by the process of eliminating the uninterested persons, every four months.

Our factory sales policy is cash on delivery—payment when the plane is turned over, if the delivery is "flyaway," or sight draft against bill of lading when it is shipped by rail. However, we have helped our distributors arrange with local finance companies so that they are able to buy what planes they need without too great an investment of their own. The cost of this is small, sometimes as low as eight per cent. on the sum involved, and by this method of financing we eliminate all danger of repossession.

When this plan is used, the distributor orders planes from us. We ship to the finance company, which receives them and pays us the balance due. We insist that the distributor pay a percentage with the order, and then the finance company turns the planes over to the distributor as he sells them, collecting from him as he collects from the dealer, taking, however, a certain percentagr as it releases each one.

An 11 Per Cent. Premium

Our company, I believe, originated the partial payment sales plan for individual airplanes. This has been used so far by about two or three dozen customers. I believe more would use it if the cost were less, but it involves payment of a premium of 11 per cent.

This 11 per cent. is added to the cost of the plane. The customer then pays down one-third of that total and pays the balance in 10 equal monthly installments. The premium covers insurance on the plane, but the buyer must protect distributor and manufacturer with a note, signed by himself and two other property owners, and by a mortgagr on the plane itself.

The local finance companies are taking over all phases of airplane purchase financing now, and I believe this is right, best for the industry and best for the buyer. The manufacturer has no business tying up his capital in financing plans at this stage of the progress of aviation; he needs it all for factory extensions, improvements of his product and the like.

Accidents *and their* Causes

By Earl D. Osborn

ACCIDENTS and their causes have been discussed as much as any subject connected with aeronautics, but the talk has been very general in its nature, and until very recently there has not been any concerted effort toward making a scientific analysis of the accidents

Such an analysis is not an easy one to make, as uniform information is hard to obtain, and as almost all accidents have several causes Often, the obvious cause is not really the most important one, and some method, which would permit a comparison of the relative values of the causes and the making of detailed sub-analyses, was necessary The lack of such a method, combined with the inertia regarding the study of accidents, resulted in attempts to remedy only the most obvious of the causes

With the increased safety and perfection of aircraft, however, we must have a more scientific analysis of accidents so that we may weigh the relative importance of the various items that tend towards safety or danger Without a more complete knowledge of the fundamental causes of accidents, much of the effort expended in improving the structural design and the aerodynamic qualities of the airplane will be wasted

In an effort to evolve a uniform system for analyzing aviation accidents, a committee was appointed which held the first of a series of 16 meetings under the auspices of the National Advisory Committee for Aeronautics, March 19, 1928 This committee was formed of Dr C K Burgess and G. W. Lewis, who represented the N A C. A., Lieuts D B Phillips and J D Barker, representing the Army Air Corps, Lieut Comdr L C Stevens and Lieut R. Brown, representing the U S Navy, Daniel de R. Scarritt, who was later succeeded by E. P Howard, and L. T Bradbury, the representatives of the Aeronautics Branch, Department of Commerce. The complete report of the Committee was published in N A C A bulletin No 308

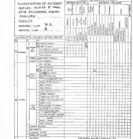


Fig 1

Divides Accidents Into 13 Classifications

The system evolved by the committee is at first glance rather complicated; but accidents differ widely in their nature and results, and the immediate cause of an accident can be traced back in most cases to an underlying cause which itself must be analyzed The Committee divides accidents into 13 classifications Class "A" consists of collisions in full flight with other aircraft, class "B," collisions in full flight with objects other than aircraft, "C," tail spins following engine failures, "D," tail spins without engine failures; "E," forced landings; "F," landing accidents, "G," take-off accidents, "H," taxiing accidents; "I," fires in the air; "J," carrier, platform and arresting gear accidents; "K," launching gear accidents, "L," miscellaneous, "M," intermediate and doubtful These classes are defined in detail in the report, so that those making an analysis can determine with uniformity the exact class into which an accident falls

A second subdivision in the classification of accidents separates those resulting in injury to personnel and those in damage to material The injury to personnel classification is further divided into class "A," in which one causing the death of an individual within 90 days is listed, class "B," an accident causing serious injury; class "C," minor injury, and class "D," no personal injury. These classification letters are worked out into a code, so that by the arrangement of the letters it is possible to determine what injuries were received by both passengers and pilots

Damage to materiel is divided into six classifications. Class "A" is for an accident resulting in a complete "wash out;" "B" is for an accident necessitating a complete overhaul; "C," an accident necessitating the replacement of a major part; "D," an accident necessitating minor replacements, while "E" is for accidents in which there is no damage to materiel Class "F" consists of potential failures, such as forced landings without damage

Thus, the accident analyzed in Fig 1 falls in class "C," because it is a tail spin following engine failure. The results to personnel are classed as "BA," showing that the pilot was severely injured and that the passenger was killed Had both the pilot and passenger been killed, the result would have been "AA" The damage to material is classed as "A," because the plane was a complete wash out

As will be seen by a study of Fig 1, the classification of accidents and the results are shown in the upper left hand corner The analysis of the immediate cause of the accident is shown directly beneath this, and is divided into failures of personnel, failures of materiel, several miscellaneous classifications and a classification for accidents with causes that are doubtful, or are undetermined Failure of personnel is divided into errors of supervisory, or other personnel. Errors of the pilot are further divided into five subdivisions Failure of material is divided into failure of power plant, structural failure and the failure of what might be termed accessories Power plant failures and structural failures are again subdivided into secondary classifications

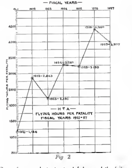


Fig 2

Thus, it will be seen that the immediate causes of accidents are divided into several major classes. These major classes are subdivided and, in most of the cases, the subdivision is again classified These broad divisions with a subsequent subdivision into detailed classifications makes it possible to classify an accident in a scientific manner and, when tabulated, gives a very informative analysis

However, the immediate cause of an accident does not tell the whole story, and it is necessary to get at the underlying cause For example, the immediate cause of an accident may be an error on the part of the pilot, but the reason why the pilot made it is just as important as the fact that he did make it The space devoted to the underlying cause of the accident, which is found on the right hand side of the form illustrated in Fig 1, is divided into the same two major classifications; that is, personnel and material The sub-classifications endeavor to show the underlying cause of the accident being analyzed Thus, errors of piloting are subdivided into lack of experience and physical, or psychological Lack of experience is subdivided into total lack of experience and lack of recent experience In the same way, errors due to physical causes are subdivided into those assigned to disease, or to poor reaction, and these in turn are subdivided into inherent or temporary

The N. A C A report gives very detailed definitions of exactly what is meant by each one of these causes and sub-causes The category into which an accident falls and the immediate and underlying causes of the accident can be set down by almost anyone having a good description of it However, the assignment of the percentages which are due to this or that cause, requires a considerable amount of judgment and real knowledge of flying

In an attempt to determine how uniform the analyses would be if made out by different persons, descriptions of the same accidents were given a number of individuals and each was asked to fill out the reports After this was done, the results were compared The assignment of causes was found to agree entirely, while the percentages differed only by small amounts

The following, quoted from the N. A C. A report is the description of a typical accident, and shows the methods used in establishing the percentages The figures written on the form shown in Fig 1 are those of this accident.

"Pilot John Doe was flying in a seaplane at 200 ft altitude over a point of land between a bay and the open sea when the engine stopped Pilot Doe had an opportunity to land either directly into the wind in the open sea or cross wind in the bay He started to land in the ocean, but at 100 ft altitude he changed his mind and attempted to turn so as to land in the bay In turning, Doe held the nose of the seaplane up, stalled it, and spun into the land The airplane was demolished, the pilot was seriously injured, and the passenger was killed.

"Doe, according to his record, was an experienced aviator with 30 hr flying during the preceding month and with recent experience in stunting airplanes

"Examination of the engine showed that one of the teeth in the magneto timing gear had stripped, the broken tooth having been drawn into the other teeth, causing the eventual stripping of all teeth The original break was determined to be a visible hardening crack

"The nature of this accident is Class C—tail spin following engine failure, as defined The classification according to results is: Personnel, Class BA; Materiel, Class A.

"In analyzing this accident the immediate cause is charged, as indicated on the analysis chart, as 75 per cent 'personnel' and 25 per cent 'material,' for the reason that the account of the accident shows that the pilot had two chances to make a safe landing and took advantage of neither of them Considering the 75 per cent, which is charged to personnel, it is obvious that this is chargeable neither to 'errors of supervisory personnel' nor to 'errors of other personnel,' so that the whole weight, 75 per cent, must be placed under 'errors of pilot' It appears further that the errors of the pilot involved errors of judgment in that he lost altitude while wavering inde-

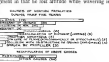


Fig 3

cisively between landing in the ocean and attempting to land in the bay It appears that poor technique was the most important single factor in that he continued to pull the nose up, still further stalling the seaplane, when he should have sensed the approaching stall It is considered that a charge of 35 per cent 'error of judgment' and 40 per cent 'poor technique' represents as near an approximation as can be arrived at in this case

"On analysis of underlying causes, it would appear that the error of judgement and poor technique were both due to a 'temporary poor reaction,' with a strong possibility of such 'poor reaction' being 'inherent' rather than 'temporary' However, in the absence of a history of the individual, this would have to be classified as temporary.

"Considering the 25 per cent. charged to 'II Material,' the entire 25 per cent obviously should be assigned to '1.

Power Plant failure,' in the second order of subdivision, and again in the third order of subdivision the entire 25 per cent. should be charged to '(c) Ignition system'

'The underlying cause of this material failure is unquestionably faulty manufacturing, and, accordingly on the cross analysis, it would be placed under the head of 'manufacturing inspection'"

This system of classification has been adopted by the Army, the Navy and the Department of Commerce The Army and Navy have very detailed description of all accidents occurring in the service, and their crash boards have

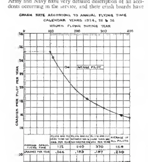


Fig 4

the facilities for very detailed examinations of surviving personnel and of material Both services expect to go back over the accidents that have occurred to analyze their classification and nature according to the new method The Department of Commerce has a committee which meets daily and at the present time is studying about 40 new accidents each week. The reports of the accidents are sent in by the field inspectors, but quite naturally it has not been possible for them to gather as much, or as detailed information from civilians as it is possible for military and naval authorities to gather

In analyzing the accidents for the first six months of 1928, the underlying causes of the accidents have not been given. Obtaining the information on which the underlying causes can be definitely established requires a great deal of investigation, and at the present time the field inspectors are not in most cases in a position to spend the time and use the authority necessary for gathering this information. The classification of accidents reported by the Department of Commerce from January 1 to July 1, 1928 is as follows:

Classification of Accident Nature

Class "A" (Collision in Air)	2
Class "B" (Collision with Ground)	25
Class "C" (Spin with Engine Failure)	17
Class "D" (Spin Without Engine Failure)	98
Class "E" (Forced Landing)	83
Class "F" (Bad Landing)	55
Class "G" (Take-Off Accidents)	44
Class "H" (Taxiing)	10
Class "I" (Fires in the Air)	4
Class "L" (Miscellaneous)	41
Class "M" (Unknown and Doubtful)	11
	390

Results of Accidents
To Pilots

Class "A" (Fatal Injury)	65
Class "B" (Severe Injury)	63
Class "C" (Minor Injury)	69
Class "D" (Uninjured)	193

To Passengers

Class "A" (Fatal Injury)	88
Class "B" (Severe Injury)	70
Class "C" (Minor Injury)	74
Class "D" (Uninjured)	206

To Material

Class "A" (Completely Demolished)	172
Class "B" (Complete Overhaul)	83
Class "C" (Major Assembly Repairs)	89
Class "D" (Minor Repairs)	42
Class "E" (Not Damaged)	2

Immediate Cause of Accident	*Percentage*
Personnel (*Pilot*)	
Error of Judgment	8.45
Poor Technique	22.95
Disobedience	4.95
Carelessness or Negligence	6.32
Miscellaneous	.62
	43 29
(*Other Personnel*)	
Supervisory	.35
Miscellaneous	3.10
	3.45
Total personnel causes	46 74
Material (*Power Plant*)	
Fuel System	5.12
Cooling System	.57
Ignition System	4.00
Lubrication System	.33
Engine Structure	1.29
Propellers and Accessories	.44
Engine Control System	
Miscellaneous	.45
Undetermined	4.59
	16.59
(*Structural*)	
Flight Control System	.85
Moveable Surfaces	.35
Stabilizing Surfaces	
Wings, Struts and Bracing	1 09
Undercarriage	1.64
Wheels, Tires and Brakes	.19
Pontoons or Boat	.08
Fuselage, Engine Mounting and Fittings	.75
Tail Skid Assembly	.19
Miscellaneous	.23
Undetermined	
	5.32
(*Handling Qualities and Instruments*)	
Handling Qualities	.44
Instruments	
Total Material Failures	22.35
Miscellaneous	
Weather	10.21
Darkness	1 28
Airport and Terrain	8.72
Other	3 90
	24 13
Undetermined and Doubtful	6.78
Grand Total	100 00

Unfortunately, the exact mileage flown by commercial aircraft in the United States is not available Provisions were made in the Congressional Act authorizing the Aeronautics Branch, Department of Commerce, to require quarterly reports from all licensed aircraft operators So far, this provision has not been enforced There is also much flying done by unlicensed planes Lack of this information does not affect the percentage figures given above, but it does make impossible a direct comparison of the risk involved in the various kinds of flying. The vital statistics given below are of interest, but, until flying

mileage is accurately established, they have comparatively little value It is interesting to note, however, that there were more accidents to licensed than to unlicensed pilots during 1928 During 1927, when the majority of flying was done by unlicensed pilots, the situation was quite the reverse The statistics are as follows:

Type of Flying in Which Accidents Occurred

Scheduled Flying	34
Student Instruction	69
Experimental	17
Miscellaneous	270
	390 Accidents

Status of Pilots Having Accidents

Licensed	195
Unlicensed	124
Letter of Authority	71
Average Age of Pilots	28 6 yr
With Medical Waiver	14
Without Medical Waiver	264

Probably the most interesting and intelligent accident report worked out on a mileage basis, which has been issued so far, is the analysis of naval aircraft accidents for the fiscal year 1926-1927. This report was published in January, 1928, before the N A C A aircraft analysis form had been devised It is, however, expected that the accidents will be reviewed and percentages worked out according to the standard form adopted by the Army, Navy and Department of Commerce. The report concerning accidents to naval aircraft follows:

"Fig 2, which graphically illustrates the improvement in aircraft safety during the past seven years, is an ex-

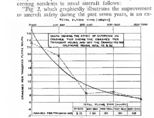


Fig 5

cellent example of the effects of improved flying efficiency The curve has undoubtedly been affected by improvements in design, but it is certain that the improvement 1927 shows over 1921 (over 340 per cent) has not resulted from better material alone Therefore it can be seen that the basic causes of aviation accidents can and are being reduced

"Fig. 3 gives ample proof of the relative importance of personnel and the marked improvement possible in this field. There is no means of ascertaining, but it is highly probable that at least half of the 20 deaths assigned to unknown causes or to weather conditions, resulted from mistakes of personnel This would credit personnel with 91 deaths or nearly 80 per cent of all fatalities

"That collisions in the air should rank among the three leading causes of fatalities is extremely disquieting Such accidents can, almost without exception, be termed avoidable. They are indicative of carelessness, unduly hazardous operations, or, in certain cases, to flying of an unauthorized nature In this connection it should be noted that close formation work is no longer considered necessary The elimination of this type of accident must be brought about.

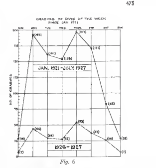


Fig. 6

"Tail spins still lead as a cause of fatalities and can almost invariably be traced to faulty flying judgment, which in turn, it is believed, is most often traceable to lack of experience in flying, or lack of experience in particular type of plane, or to too infrequent flying

"In Fig 4, a study has been made of the effect that increased flying per year has upon crashes and is extremely interesting in the results obtained Despite the fact that pilots who flew in the neighborhood of 400 hr. a year were in the air four times as much as those in the 100 hr class, and consequently were exposed to flying hazards for a period of four times as long, their crashes per year were 40 per cent less No better proof

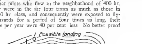


Diagram 1

could be had of the results to be expected from too infrequent flying and apparently the saturation point, or point where a pilot begins to show signs of staleness from too much flying, is a great many hours beyond the 400 hr point

"Fig. 5 should prove of equal interest as it shows the effect that experience or total flying has upon the crash rate. In order that results obtained might not be subject to the contention that fliers who have been in aviation for some time are not flying as much as they formerly did, and consequently have a lower crash record, the crashes

per thousand hours flying time have been used as basis of calculation It may be seen that during the first 1200 hr, the reduction in crashes is very marked The logical conclusion to be reached from a study of Figs 4 and 5 is that it is highly desirable to increase the annual flying time of all pilots, paying particular attention to those

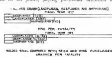


Fig 7

whose tendency, it appears, is to fly in the neighborhood of 100 hr. per yr The effect should be to affect a reduction in crashes, both by increasing the pilot's annual and total flying time

"Mondays and Thursdays are the peak days in respect to crashes as may be seen from Fig 6 It is hardly necessary to point out that these two days follow holidays However, it is believed that Thursday crashes may be influenced somewhat by the amount of flying done on that day."

Fig. 7 brings out some interesting facts which apparently have been little realized The Navy does about an equal amount of flying with land planes and with seaplanes The seaplanes fly considerably farther without having any crashes, but apparently when they do have a crash, it is considerably more serious in its nature The safety of welded steel fuselages as compared to the old fashioned wood and wire construction is also well illustrated The Navy report also gives the number of flying hours per crash for all the different types and models of planes which it uses This list is not given,

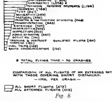


Fig 8

as in many cases, the mileage for a particular type of plane is so small that no fair comparison is possible It is quite evident, however, that certain types of planes are distinctly more dangerous than others, but without knowing a good deal more about the matter, it would be unwise to draw conclusions For example the HS2L, which is a pusher flying boat of ancient vintage, rather unstable and underpowered, holds top place in the safety figures This type of plane had 100 per cent freedom from crashes and flew just far enough to head the list from the safety point of view Paradoxical as it may seem, the reason for its safety record is probably the fact that the plane is dangerous to fly, and that people know it and use a greater amount of caution In fact, there are strict regulations against stunting it or performing violent maneuvers

Fig 8 shows the number of hours for the various types of flying per crash It will be seen that a much fewer number of crashes results from indoctrination flights than from any other type. Flying for purposes of indoctrination consists of carrying non-aviation personnel on demonstration flights in order to illustrate the uses of aircraft Due to the high type of pilot chosen for this work and to the conservatism of the flying, it is more than three times as safe as any other type

Fig. 9 gives an analysis of the causes of the various crashes The information for the compiling of these

Fig 9

statistics was very complete, but the method of presentation is not nearly as clear as it will be under the new system that has been adopted

If the Department of Commerce can obtain as complete information in regards to crashes as the Army and Navy do, we should soon have figures which will give a scientific basis for accident prevention work The new N. A. C. A. formula is certainly the best that has been developed so far, and is much less apt to lead to false and incomplete conclusions than most types of accident reports If the same system were adopted by foreign countries, very interesting comparisons could be made, and undoubtedly it would offer a stimulus to international competition in increasing the safety of aircraft

Although the new N. A. C. A. system of accident analysis is a vast improvement, and is much more scientific than previous systems, yet, it must not be regarded as perfected Unless intelligently studied, it is very easy to draw false conclusions from statistics To obtain proper deductions from an analysis of accidents, all factors must be given proper consideration, and an intelligent approach must be made There will also be need for detailed study of special phases, such as the relative safety of different types of planes. The field of accident study is a comparatively new one, but it offers many interesting and extremely valuable possibilities

The New York Show

Record Attendence Features Unsanctioned Distributor and Dealer Exhibition Sponsored by Aviators' Post No. 743

By R SIDNEY BOWEN, JR.

WHAT financial benefit has been derived by the exhibitors in the New York Aviation Show, since the affair was officially open at Grand Central Palace on February 6, is a matter for considerable speculation However, as regards the sponsor, Aviator's Post No 743 American Legion and the professional promoters back of the Post, the Show has unquestionably been a most gratifying financial success Not for eight years have the natives of the Empire State city had the opportunity to view an aeronautical display held within the city's limits, and when that opportunity presented itself on February 6 the airminded and unairminded alike took full advantage, with the result that the New York Show has "played to a full house" every single day since. In fact, as we go to press, there is talk of continuing the affair for the remainder of this week

The Show itself might be classed as a dealers, distributors and outsiders exhibition as relatively few of the big aeronautical concerns are exhibiting under their own name, and many newly formed organizations have taken space to exhibit products some of which are strictly aeronautical, and others which require considerable stretching of the imagination to associate them with the field of aviation The absence of the majority of the well known companies was due to the fact that the Show was not sanctioned by the Aeronautical Chamber of Commerce. And that fact, incidentally was the main topic of the airminded at the Show As one went from exhibit to exhibit one hears continually the ifs, ands, buts, whys and becauses of failure to receive the sanction, or the reasons why sanction was not granted According to those in a position to know due to a somewhat inexcusable misunderstanding, sanction was not applied for nor were any definite moves made by the other party to grant the sanction. It would seem to be that Aviators' Post and the Aero Chamber of Commerce were equally at fault Each has been taught a lesson and if there be a "second time" it is an odds-on bet that there will be a far greater amount of cooperation forthcoming from both parties, provided, of course, that the sparks do not begin to fly between now and then

The feature of the Show, if there really was a feature of the affair, was the display of products entered by Columbia Air Liners, Inc, of which the well known trans-Atlantic air passenger, Charles Levine, is the head. Three planes and an engine made up the exhibit Of the planes, a new convertible, amphibian of the "Triad" Series-CAL 1 powered with a Whirlwind was the most interesting from an aeronautical viewpoint However, from the public's viewpoint, an all metal inverted Packard powered mail plane took the blue ribbon The third plane was a small single seater sport monoplane, of a type which has participated in several French light plane contests and is powered with a 40 hp Salmson engine The engine is a 280 hp at 2600 r p m (reduction geared) nine cylinder aircooled radial named the Columbia but is strongly reminisant of the Farman engine and has FF (Farman Freres) on the crankcase It is stated that this engine will be standard equipment on the Triad

The Triad is a high wing monoplane of the usual construction with the exception that an over sized detachable pontoon is fitted to the underneath forward part of the fuselage making the plane a landplane, flying boat or amphibian, as may be desired According to reports the plane has good performance as a land plane The upward curve of the pontoon has necessitated a "well" to allow for propeller clearance At two points the clearance is little more than an inch, a fact which might not prove particularly healthy if ice collected on the pontoon Then too, there is the item of vibration caused by the prop tip passing below the top level of the pontoon, but, according to the officials of the company, in the case of the

Front quarter view of the new Columbia "Triad" Series CAL 1

Triad the item of vibration does not exist. According to those self same officials changes are to be made in future models, one of the most important being the lowering of the bottom level of the windshield to permit of better forward visibility. Taking all in all the Triad seems to have some good possibilities and its development in the future should be watched with more than a little interest. A complete technical description of the Triad will appear in an early issue.

The all-metal mail plane, titled Uncle Sam and designed by two Frenchmen, is an exceptionally well stream lined monoplane which, on paper, can carry enough fuel for a non-stop flight of around 6,000 mi. As yet it has not left the ground and until it does, and shows a performance equal or better than the Lockheed Air Express, its main features are that it is an exceedingly "showy" design and that, according to reports, it cost a quarter of a million dollars to build. The Columbia engine and the sport job both "look" good, and, in the opinion of the Company's officers and pilots, are good. Granting that fact for the sport job, it is a far, far cry from a good performing single seater plane to a good selling market, but perhaps the Company's sales force will be able to prove that a fair sized single seater market exists.

Included in the exhibits entered by the manufacturer himself were nine companies which are already well known to the industry. They were, Bellanca Aircraft Corp, which exhibited a CH model; Bourdon Aircraft Corp. which exhibited its "Kitty Hawk" biplane; Brunner Winkle Aircraft Corp which exhibited its "Bird" biplane in which Miss Eleanor Smith recently established a new endurance record for women pilots; Buhl Aircraft Corp which exhibited its "Special Airsedan; Chance Vought Corp which showed its famous "Corsair", Hamilton Metal Plane Co which exhibited its all metal monoplane; New Standard Aircraft Corp (formerly Gates-Day Aircraft Corp) which displayed its "New Standard" biplane; Szekely Aircraft Corp which exhibited its "Flying Dutchman", and Aeromarine Klemm which showed

The Arrow Sport Biplane powered with a Le Blond radial

its AKL-25 low wing monoplane. All of these planes received equal attention from the public, as well as "old friend" attention from visiting members of the industry.

Of the newer participating members of the aeronautic industry on this side of the Atlantic, who are either manufacuring their own design, or have secured the American manufacturing rights of a foreign plane, eight were represented at the Show. They were American Aeronautical Corp which is handling the Savoie Marchetti flying boat and Isotta Franchini engines; Columbia Air Liners, Inc, which has already been mentioned, Cresent Aircraft Corp, which displayed an eight passenger Whirlwind powered monoplane built under the personal supervision of Clarence Chamberlain; Mill Basin Aircraft Corp which exhibited its "Flying Boat" Biplane; Moth Aircraft Corp, which showed its American built (or soon to be American built) DH "Moth" biplane, U S Aircraft Co, of N J, which displayed its "Air-istocrat monoplane, and Arrow Aircraft & Motors Corp which exhibited its Arrow Sport Biplane.

Apart from the Columbia jobs the other planes of this group to cause one to stop and take a second look were, first, the Crescent monoplane, principally because it reminded one of the Bellanca plane that Chamberlain flew to Germany. It is stated to have certain features not included in the Bellanca plane, but as yet the craft has not been flown, and the "proof of the pudding is in the eating." Later models are to be powered with the new 300 hp. Whirlwind, but for the Show a 200 hp. Whirlwind was installed.

Front quarter view of an OX5 Brunner-Winkle biplane.

The next to catch the eye, particularly if one entered the building by the rear door, was the Mill Basin Flying Boat. This craft "looks" good, perhaps because it is a Whirlwind powered Seagull hull fitted with single bay, high lift wings. However, the workmanship on the job is clean and as a whole the plane gives one the impression that it has a good performance.

The next attraction, whic incidentally is listed in third place because it is located on the second floor, is the Arrow Sport Biplane. This little 'cloud dodger" is an exceptionally well built two place (side-by-side) biplane that can be used as a training plane as well as for sport flying. This plane was exhibited at the Chicago Show last December but it made its first appearance in the east during the New York affair. The points that catch the eye at once are the tapered wings, their stagger angle and the absence of interplane cross bracing. It is stated that a 60 hp. engine takes its 25½ ft. wing spread off in a run of 100 ft. There should be a good market for this plane, if its performance conforms with the reports we hear.

The "Moth" of course needs no introduction to the aeronautically inclined. Its record speaks for itself, and with a Wright Gypsy engine as the power plant the American made Moth should find a healthy market that will probably continue to increase as the price of the plane continues to decrease. The same comments go for the Savoie Marchetti monoplane, with the exception perhaps that competition with American water craft may be a bit more keen. The progress of the American company handling this plane should be worthy of notice as time goes on.

A total number of 12 factory representatives, distributors, dealers, etc of well known plane manufacturers exhibited at the Show. These included Air Associates (Lockheed Vega and Avro Avian), Curtiss Flying Service, Inc (Curtiss Robin) Dr Arthur LaRoe (Alexander Eaglerock); E H Holmes & Co (Swallow Biplane), Eastern Aeronautical Corp (Ryan Brougham and Command-Aire Biplane); Thomas B Neelands, Jr. (Travel Air); Atlantic Air Service, Inc. (Cessna and

Spartan); George A. Wies, Inc (Mono and Stearman); New York Aircraft Distr Co. (Advance), Rodabec Aircraft (Laird and Stinson, Jr., and Roosevelt Flying School (Travel Air Biplane).

One plane exhibited was a last minute arrival—straight from the west coast in 18 hr. 21 min 59 sec—the Lockheed Air Express powered with a Pratt & Whitney "Wasp" engine (N A. C A. cowling) and piloted by Capt. Frank Hawks with Oscar E Grubb as passenger-mechanic. This plane attracted considerable interest in view of the fact that its record breaking pilot was on deck to answer the million and one questions that the unairminded wanted to ask. And, as a matter of fact it was Mr and Mrs. New Yorker's first real chance to even get near a famous pilot so soon after the accomplishing of his feat. Naturally, the New Yorkers needed no second invitation.

Among the engine exhibits one noticed the absence of the big companies such as Wright, Pratt & Whitney, Packard, and Curtiss. True, Curtiss Flying Service, Inc had a Challenger in its booth but that was the only power plant of the Garden City and Buffalo firm that was exhibited. It is stated that "by agreement" the leading engine manufacturers stayed out of the Show. However, it is perhaps an item of interest that Wright and Curtiss engines that had seen service in famous flights of the past were included in the historical exhibit of R. H. Macy Co, the New York department store.

From the standpoint of attractive display the Isotta Franchini engines received the most attention. In this group were two or three high powered water-cooled engines, one of the 18 cylinder type, a 12 cylinder V aircooled job and a six-in-line aircooled job that was particularly interesting if for no other reason than that the cylinders and crank case are cast integral. This engine is rated at 80 hp and seems to be worth closer inspection.

Some of the other engine exhibitors included: American Cirrus Motor Corp., which exhibited a four-in-line Cirrus to be made in this country (with certain alterations), E W Bliss & Co, which showed a Bliss-Jupiter to be made in this country (as well as a Bliss-Titan and a Bliss Neptune); Continental Motors, which showed its new, yet untried, radial, Kinner Airplane & Motor Corp, whose product needs no introduction to the reader; Wright-Tuttle Aircraft Motors Corp, which gave the first American showing of the Belgium Renard engine that has made a name for itself in the 100-hp. class in Belgium, and Szekely Aircraft Corp., which exhibited its SR3, a 40-hp three-cylinder radial.

Perhaps, it might be said that from the viewpoint of things aeronautical, the accessory and equipment exhibits were the weakest part of the show. There were, of course, few of the well-known companies exhibiting, but the majority was made up of new "outfits" and firms belonging to other industries. In fact, one did not have to be interested in airplanes to be able to buy things at the show. There were special preparations to keep the windshield of your automobile clean, tapestry, cheap jewelry, Boy Scout equipment, fire extinguishers, and motorcycles and side cars, etc.

The most impressive thing about the miscellaneous exhibits was the speed with which the public, exhibitors and everyone else were able to dodge the million-odd toy planes that young hands were releasing all over the place. It seemed to be consensus of opinion of those present (as visitors) that every single toy and model airplane builder in these United States exhibited at Grand Central Palace. However, as they say, the boy of today is the pilot of tomorrow. If that be true, then, according to scenes viewed at the Grand Central Palace, New York will be able to boast of no less than nine million pilots "tomorrow."

To get back to the well-established aeronautical companies exhibiting, it can be said that the most attractive booth was that of Eclipse Machine Co. This exhibit consisted of aviation starters and generators, all of which were exceedingly interesting, to say nothing of the perfect workmanship that had been put into their manufacture. A bit less attractively arranged but equal in workmanship and utility were the propellers exhibited by the Hamilton Aeronautical Corp. One in particular caught the eye, for it was a magnesium prop that had seen 150 hr in the air and appeared to be in excellent condition. Developments with this propeller are worth watching, if for no other reason than the fact that a saving in weight of about 15 per cent over dural is possible.

Some of the other "old-timers" exhibitin were: Edo Aircraft (pontoons), Robert Bosch Magneto Co, Inc. (Magneto products), Heywood Starter Corp (starters);

A Wright Whirlwind powered Bellanca-CH monoplane.

Nicholas-Beazley Corp. (accessories and equipment); Snap-On Wrench Co. (tools); Texas Pacific Coal & Oil Co (fuels); Tidewater Oil Sales Co (fuels); Arch Roof Const Co (hangars), Crouse-Hinds Co (lighting equipment), Summerill Tubing Co (tubing), and Irving Air Chute Co. (parachutes), etc.

The laugh of the show (that was intended) was furnished by the Ruggles Orientator Corp, which had one of its Orientators set up in the booth. From opening time till closing time that section of the Grand Central Palace was ruled by the one-way traffic law. That is, when any of the spectators decided to move on. With no dangrr of spinning to the ground or force landing in mid ocean, the unairminded was able to get some of the so-called thrill of flying by seating himself, or herself, in the orientator and "setting the wheels in motion." There were many who desired that thrill, and as a result there were a lot of laughs, and a good time was had by all, as it were.

And last, but of course not least, was a booth devoted to what the well-dressed aviatrix should wear, and what miladi has accomplished in the field of aeronautics. In charge of this section were Lady Jane Mary Heath, of London-to-Capetown fame, and Miss Amelia Earhart, who has the distinction of being the very first member of the fair sex to travel successfully as a passenger the North Atlantic air route.

In conclusion, we repeat that the New York Aviation Show was indeed a financial success for its sponsors and promoters. It was rather well staged and quite interesting. And while perhaps it did not prove to be a big money maker for the exhibitors, it certainly created more airmindedness in New York City than there ever existed before. And after all, a man must be airminded before he can be regarded as a good prospect for airplanes, engines, equipment, or any of the other thousand and one different things that are classed under the heading of aeronautics.

AIRPLANE DESCRIPTIONS

The Monocoach

AN airplane similar to the Monocoupe, but having a capacity of four persons, including pilot, is now being manufactured by Mono Aircraft, Inc, Moline, Ill The new plane, which is called the Monocoach, is an externally braced high wing cabin monoplane powered with the Velie L-9 engine, which develops approximately 170 hp It has a wing span of 40 ft., an overall length of 26 ft. 2 in, and an overall height of 7 ft 6 in The weight of the plane empty is 1700 lb and the gross weight 3,000 lb

The cabin, which is exceptionally roomy and comfortable, has two large doors for easy entrance or exit, one on either side, just forward of the rear seat There is a small space between the front seats and, in addition, the backs of these seats fold forward, permitting easy entrance to them Ample window space is provided to give good vision in all directions An unusual feature is

A front quarter view of the "Monoach" manufactured by Mono Aircraft Inc It is powered with the Velie L-9 engine.

the covering of the top of the cabin with pyralin, which provides excellent vision above and behind A curtain is furnished which may be drawn over this when it is desired to shut out the sun All of the glass used is nonshatterable, and that in the doors slides up and down as in an automobile

Welded steel tubular construction is used throughout the fuselage and tail surfaces The stabilizer is adjustable in flight and the fin on the ground The tail surfaces are externally braced The elevator control is by means of cables, and the stabilizer adjustment by push-pull rods

The wings are of conventional wood and fabric construction The wing beams are of "I" section and of grade "A" airplane spruce The wings are pin connected at the fuselage and are braced at a point about 12 ft from the longerons The U S A 35-B airfoil section is used

The ailerons are of wood construction and of the Frieze type, the hinge being 25 percent of the aileron chord. It has been demonstrated in flight that the force exerted by one finger has been sufficient to operate the ailerons

The landing gear, which has a tread of 10 ft, is of the divided axle type, with a long oleo strut The wheels are equipped with Bendix brakes which can be operated separately or together The brake pedals have been installed close to the rudder pedals so that both may be operated at the same time if desired

Fuel tanks having a capacity of 66 gal are carried in the wings outboard of the fuselage This provides sufficient fuel for 5½ hr flight at cruising speed. Instruments include a compass, turn and bank indicator, tachometer, oil pressure gauge, oil temperature gauge, altimeter, air speed indicator and clock A strong sturdy auxiliary tail skid is provided to protect the tail surfaces from injury in the event of failure of the normal tail skid

Additional specifications are as follows.

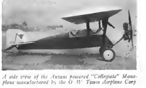
Wing area	228 sq. ft.
Wing chord	75 in
Aileron Area	17 sq. ft.
Elevator Area	12½ sq. ft.
Stabilizer Area	18 sq ft
Rudder Area	9 sq ft.
Fin Area	4½ sq. ft.

"Collegiate" Monoplane

DESIGNED to meet the demand for a training or sport plane, the "Collegiate" monoplane is soon to be produced in quantities by the O. W Timm Airplane Corp, Glendale, Calif. This airplane, which is of the tandem cockpit, externally braced type, is powered with an Anzani 100-120 engine Other power plants in the 80-150 hp range also may be used

The Collegiate has a wing span of 35 ft, a length of 24 ft, 7 in and a height of 8 ft, 5 in The wing area is 236 sq ft The weight of the plane empty is 910 lb and the weight fully loaded 1,760 lb With the Anzani engine, the high speed is 118 m.p h and the landing speed 35 m.p h

Wings are in two sections and are braced with tubular struts The wing spars are of "I" section with five ply webs and spruce caps The ribs are of original design and are a combination truss and web construction Two fuel tanks are mounted in the wings The ailerons are long and narrow and are very effective and easy to operate. They are constructed of plywood and fabric covered. Two independent sets of wires and fittings are used in the aileron control system



A side view of the Anzani powered "Collegiate" Monoplane manufactured by the O W Timm Airplane Corp

The fuselage is constructed entirely of chrome molybdenum steel tubing with a detachable engine mounting Removable dual controls are standard equipment The seats are well upholstered and have deep leather covered spring cushions New small type Pioneer instruments consisting of altimeter tachometer, oil pressure and oil temperature gauges are used.

Landing gear is of the hydraulic type with divided axles and equipped with 30x5 in wheels The tread is

7½ ft The tail skid with its rubber shock absorber is removable as a unit The skid shoe is surfaced with "Stoodter" for long service.

Tail surfaces are constructed of chrome molybdenum steel tubing The stabilizer has a large range of adjustment Elevator horns are inside of the fin There are two independent sets of control wires and fittings to the elevators and rudder

American Eagle "Flyabout"

ONE of the recent offerings of the American Eagle Aircraft Corp, Kansas City, Mo, is the "Flyabout," Model A-429, a two place folding wing sport biplane This plane, which has been designed for the use of flying clubs, sportsmen and business men, is powered with either a Szekely SR 3 or a LeBlond 60 engine With the LeBlond engine the high speed is 100 m.p h and the cruising speed 85 m p h, according to the specifications furnished by the manufacturer

The Flyabout has an overall length of 19 ft 6 in, a wing span of 27 ft 11 in. and a height of 7 ft 9 in The total wing area is 168 sq ft The weight of the plane empty is 595 lb, the useful load 400 lb and the gross weight 1,095 lb.

Ribs Fabricated in Jigs

Wing spars are of Sitka spruce, routed for lightness and the ribs, which are fabricated in jigs, are made of spruce and laminated mahogany plywood The wing chord is 4 ft 3 in. Both upper and lower wings are rigged at an angle of incidence of 2 deg and the stagger is 0 deg The gap is 4 ft 3 in giving a gap chord ratio of 1. Support are provided at the lower edge of the fuselage to hold the wings when they are folded The plane may be taxied or towed with wings in the folded position

Fuselage, undercarriage, engine mounting and tail group structure are constructed entirely of welded steel tubing No wire or rod type trussing is employed in any

Front quarter view of the "Flyabout," Model A-429 developed by the American Eagle Aircraft Corp

part of the fuselage structure The cockpit is finished in Fakrikoid and is comfortably cushioned A terne plate firewall separates the power plant compartment from the remainder of the plane A small door on the right side affords access to the cockpit.

Conventional stick and rudder bar controls are installed and dual controls can be furnished when the plane is to be used for training purposes An illuminated instrument panel containing tachometer, altimeter, oil pressure gauge and temperature gauge, is provided A 12 gal. gasoline tank is provided and the oil capacity is 1½ gal Landing gear is of the divided axle type

The "Whitey" Sportplane

THE "Whitey" Sport, a two place, high wing monoplane, has undergone a rigid series of preliminary flights and has proven itself exceptionally airworthy for a light plane A number of these airplanes have been manufactured by the White's Aircraft Co, Des Moines, Ia, within the past few months

This monoplane is an open cockpit type ordinarily powered with a six cylinder Anzani engine Three cylinder 45 hp Szekeley engines have been installed in two models Still another model has been turned out with a 60 hp. LeBlond power plant All of these engines are interchangeable with the exception of the LeBlond which requires a special mounting

The Whitey Sport was designed primarily for the private owner and light-plane flying clubs It is the result of over twelve years experience with lightplanes by the designer, Harold L White, chief engineer for the Whites' Aircraft Co

On one occasion Capt J C Bryan in a three cylinder Szekeley powered plane remained in the air 2 hr and 30

Rear quarter view of the two-place "Whitey" Sportplane made by the Whites Aircraft Co The first plane was powered with an Anzani engine

min. He attained an unofficial altitude of 10,500 ft Jack Walton piloted the plane on its first long cross country trip to Omaha, Neb. This 170 mi trip was made in 1 hr and 42 min

The wing has a span of 31 ft and a chord of 4 ft. 3 in, giving it a total area of 130 sq ft The overall length of the plane is 18 ft 4 in and it is 6 ft 6 in high with tail skid on the ground. The weight empty is 485 lb and fully loaded is 850 lb.

The wing is braced externally by four streamline struts from the lower longerons The landing gear is of all steel through axle type wrapped with shock cord and has a tread of five feet Split type rubber disc landing gear is optional The tail skid is all steel, shock cord wrapped

The fuselage is built up from Army specification steel tubing and welded throughout No wire bracing is used in the fuselage, the entire structure being built in the form of a truss. Both wing and fuselage are fabric covered

Side by side seating arrangement is used in the cockpit which is upholstered in leather There is an abundance of leg room and excellent visibility is afforded The landing gear view is unobstructed which is an excellent factor in student training Dual controls are optional Gasoline and oil are carried under the cockpit cowling The fuel capacity is 10 gal The engine is fitted with cowling and spinner cap which fairs into the fuselage

The wing is built in three sections, the center section fastened to the fuselage by the usual type struts of streamline tubing The wing is built up of wooden spars and spruce ribs Steel wires and compression members are used in the drag bracing The leading edge is covered with plywood to insure a permanent contour The tail unit is constructed entirely of welded steel tubing

Glider Men Hold Annual Meeting

National Association Makes Plans for Promotion of Sport

DETROIT, MICH.—The first annual meeting of the National Glider Association was held here on February 6. This organization, formerly known as the Evans Gliders Association, was formed for the purpose of encouraging the development of gliding as a sport in this country Edward S. Evans president of the Association, has put up a $4,000 trophy to be competed for annually and has also put up a series of cash prizes. The contests are to be held under the auspices of the N. A. A. and it is hoped that there will be keen competition A number of clubs have already been started and more are in process of formation.

Among those present at the meeting were Edward S. Evans, Prof Peter Altman, Col L. H. Britten, Harvey Campbell, Carl B. Fritsche, Maj. Reed Landis, Earl D. Osborn, Prof. F. W. Pawlowski, Carl F. Schory, William Scripps, Jr, and D. F. Walker, manager of the Association

To Withhold Blueprints

Besides the regular business of an organization meeting, various points of policy were discussed One of the most serious matters was the question of whether blue prints of gliders should be sent to all requesting them. Although gliders are comparatively simple they are in many ways as hard to build as are regular airplanes It was the feeling at the meeting that unless the group asking for the blue prints was in touch with a competent engineer or aircraft constructor they should not be furnished with blue prints. The matter was referred to a technical committee for further study

A committee was also named to study the matter of sending out suitable publicity. It was pointed out that the German glider association had more than 200,000 members and it was believed that gliding could be widely extended in the United States. A financial committee was appointed for the purpose of raising funds It is hoped that the association will receive donations, but after it is underway the membership should be able to furnish support

The matter of supervision of the local gliding clubs was discussed It was pointed out that gliding could be very safe but that unless it were properly supervised it might lead to many accidents which would injure the reputation of the sport.

In the afternoon the directors went to the Scripps Farm which is the proving ground for Gliders, Inc., which concern is building primary gliders These machines, patterned after the German craft, are very strong but purposely are built to be aerodynamically inefficient so that the students may not fly too high or too fast.

The demonstrations were made from the top of a gently sloping hill about 50 ft in height The gliders were launched by means of two lengths of rubber cord about 150 ft. long which were stretched out by four men first walking and then running, on either side of the front of the plane. At a given signal the men who were holding the tail of the glider would let go and the glider would be catapulted into the air. The method reminds one of a boy's sling shot developed on a giant scale

After Mr Scripps and a German pilot had given demonstrations, Major Landis made a very nice flight of 150 or 200 ft The performance was closed by Earl D. Osborn who made three flights the last two being unintentional and due to overcontrolling before landing

Hamilton Plans Doubled Output

MILWAUKEE, WIS. — Immediate increase in facilities at the new propeller plant to bring double output was announced by Thomas F. Hamilton, head of the Hamilton Metalplane Co. and Hamilton Aero Manufacturing Co., upon his return from New York City, where a deal was closed merging these concerns with United Aircraft & Transport Corp, the Boeing-Vought-Pratt & Whitney combination More than 100 men will be added to the force and between $60,000 and $70,000 will be spent for new machinery.

Many Sales Reported At New York Air Show

NEW YORK, N Y.—Airplane sales totalling about $1,000,000 and sales of engines reaching several hundred thousand dollars were reported by various manufacturers at the New York Aviation show as we go to press These sales include contracts closed with distributors and dealers as well as with individuals and concerns In addition, a large number of prospects and scores of provisional sales expected to be closed definitely following the show were reported Accessories representatives made extensive sales, also

Exhibitors generally reported considerable enthusiasm over the conduct of the show and the large attendance The three floors of the exposition were thronged every day and on Saturday, Sunday and Lincoln's Birthday they were crowded with spectators of all ages Many exhibitors had spoken for space at next year's display before the close of this one, anticipating an increased demand for accommodations

It is said that there were fully 200,000 paid admissions

Hawks' Record Flight Demonstrates Cowling

NEW YORK, N Y—The record-breaking transcontinental flight of 18 hr 21 min. 59 sec accomplished by Capt. Frank M Hawks and Oscar E Grubb, February 4 and 5, was the first commercial demonstration of the possibilities of the N.A.C.A cowling with which the Lockheed Air Express was fitted The machine was the first commercial plane to be so equipped and the device is credited with making the record trip possible in spite of adverse weather conditions

The Lockheed left Los Angeles at 8 37 30 P M (Eastern Standard Time), February 4, and arrived at Roosevelt Field, L I, at 2 59 29 P M the next day, beating Arthur Goebel's mark by 36 min and 1 sec. Severe weather was encountered at Roswell, N M and continued practically the rest of the trip Fuel for the Pratt & Whitney Wasp engine was pumped into the main tanks by Mechanic Grubb, who experienced difficulty from the gasoline fumes

Capt Frank M Hawks

The fliers were greeted at the New York City Hall by officials while the plane was installed in the New York Aviation Show The cowling drew particular interest Hawks is Technical Advisor on Aeronautics of The Texas Company.

Consolidateds for Fairchild

NEW YORK, N Y.—Contract orders for aircraft instrument boards and instruments for the entire 1929 airplane output of the Fairchild Aviation Corp of Farmingdale L. I, has been received by the Consolidated Instrument Company of America, Inc, this city. Estimated business for the year from this one source is expected to be in excess of $100,000, it is stated by J. Leopold, president of the Consolidated firm It is said that the order just placed makes the Fairchild company the 18th aircraft manufacturer to adopt Consolidated instruments as exclusive standard equipment on all planes

Columbia Air Liners' amphibian monoplane with detachable float feature

Lindbergh Completes Pan American Flight

MIAMI FLA.—Colonel Lindbergh and Raymond J Merritt piloting mail planes of Pan American Airways, arrived here February 13 and thus completed the first round trip of the newly inaugurated air mail service. Merritt's plane made the northward trip only, being pressed into service to carry the large volume of mail, 859 lb, scheduled for transport to this country

The Sikorsky amphibions left Cristobal February 10 flying to Managua Nicaragua, with stops for fuel at David, Panama and Punta Arenas, Costa Rica in 7½ hr Lindbergh flew directly to Belize, British Honduras on February 11 in 6 hr 57 min., while Merritt made a stop on the way at Tela. The planes reached Havana February 12 in 12 hr 36 min. with several stops.

Lieut Christian Schilt, hero of Marine Corps air exploits in Nicaragua, flew with Colonel Lindbergh part of the time, having received a leave of absence from the Corps to act as Miami superintendent, Pan American. The 2000 miles of water and jungle country were negotiated without difficulty and according to schedule for the most part. No equipment trouble of any consequence was experienced throughout the trip

American Eagle Turns Out 14 Planes in Week

KANSAS CITY, MO—Production in the factory of the American Eagle Aircraft Corp of Kansas City hit a high point in a recent week when fourteen airplanes were delivered to purchasers.

A consignment of five planes was flown to Texas by pilots for Southern Airways, Inc., which has signed an airplane contract for 50 planes, and will be distributor in Texas L. A. Winship is president of Southern Airways, Inc

Others went to W. DelBigio, distributor in Winnipeg, Canada, the McKenzie-Morrow Aviation Co, Portland, Ore., Tri-State Air Lines Inc, Sioux City, Ia, and Associated Aircraft, Inc., California distributor Four planes were shipped to Associated Aircraft.

Miss Trout Sets New Record

MINES FIELD, LOS ANGELES, CALIF—Miss Bobby Trout, 22, set a new endurance mark for women February 11 when she landed here after 17 hr 5 min. and 37 sec. aloft in a Golden Eagle monoplane She bettered the former record of 13 hr 16 min 45 sec held by Elinor Smith of Freeport, L. I, by almost four hours. Miss Trout, who landed at 10 16 22 Monday morning, had taken off at 5 10 45 the afternoon before

Thaden Concern Sold To Pittsburgh Group

SAN FRANCISCO, CALIF—Purchase of the Thaden Metal Aircraft Co of San Francisco by a group of Pittsburgh capitalists and immediate removal of all its activities to the Pennsylvania city has been announced here by H. V. Thaden general manager of the California corporation

A broad program of development of metal aircraft construction is to be worked out, Mr Thaden said, with a number of experimental planes to be built first and a model for quantity production determined upon after these have been thoroughly tested. It is stated that arrangements for marketing the output, when ready, have been completed with a large and well established airplane concern

The T-1, first plane constructed by this company, has been licensed for commercial use and sold to a Pacific Coast buyer The T-2, a smaller craft embodying advances in construction over the first plane, will be taken East for use in experimental work, Thaden said.

Report Huge Engine Order

LOS ANGELES, CALIF—Contracts with the Wright Aeronautical and Pratt & Whitney companies for 350 engines costing a total of $2,400,000 recently were reported closed by the Fokker Aircraft Corp It was said that the order involved 200 engines of 425 hp and 150 of 525 hp. The engine companies have declared, however, that the negotiations over the contracts, which have been pending some time, have not been completed

Levine's "Triad" Tested in Flight

Amphibian Monoplane of Columbia Air Liners, Inc., Has Novel Float

NEW YORK, N. Y—Flight tests were made recently on the amphibian monoplane "Triad" developed and built by Columbia Air Liners, Inc, headed by Charles A. Levine, and in these trials, the craft is reported to have attained a top speed of 130 mph It is designed for either the "New Whirlwind Nine" or the 300 hp. Columbia, the company's new engine, though a J-5 power plant has been placed in the initial plane exhibited at the New York Aviation Show following the tests

The outstanding feature in the design of the Triad is its quick convertability from a landplane to a seaplane or amphibian. The craft is essentially a braced monoplane of conventional type with a retractable landing gear and a hull or main float. Either hull or landing gear are readily detachable, and when both are in place, the craft may be used as an amphibian because of the retractable landing gear. The hull is constructed of wood and duralumin and weighs approximately 300 lb It can be detached from the fuselage by the removal of four bolts

The Triad, which has accommodations for five passengers, pilot and co pilot, has a wing span of 49 ft., an overall length of 33 ft. and a height of 9 ft. The wing area is 324 sq ft. and the gross weight 3,800 lb A welded steel tube fuselage of the usual type with fabric covering is employed. Access to the cabin is gained through doors in the side of the fuselage and the interior finish of the cabin and pilots' compartment is comparable to that of an automobile Windows are provided in the front, sides and top of the cabin.

Has Unusual Control

An overhead control device having a wheel, which can be swung in front of either of the forward seats is also an unusual feature of this craft. The control for the hydraulic retractable landing gear is located between the seats. An indirectly lighted Pioneer instrument panel is mounted in the pilots' compartment

A welded aluminum gasoline tank having a capacity of 64 gal is placed in the fuselage and a quadruple system of outlets from the tank insures positive flow in practically all attitudes of flight.

The general specifications of the Triad are as follows:

Seating Capacity, Pilots and five passengers
Engine—Wright J-6 or Columbia 300 hp. (optional)

Span	49 ft.
Length over all	33 ft.
Height	9 ft.
Wing area	324 sq. ft.
Wing loading	11.7 lb. per sq. ft.
Power loading	12.65 lb. per hp.
Weight gross	3800 lb.
Fuel capacity	64 gal.

Fuselage construction—Steel tube, welding joints
Wing construction Braced wood spars and ribs

Type of control	Wheels and pedals
Landing Gear	Special CAL design

Warner Building Engine Factory

Buys Six Acre Site in Detroit Area for Modern Plant

DETROIT, MICH.—The Warner Aircraft Corp., manufacturers of the Warner "Scarab" 7 cylinder, 110 hp radial air-cooled engine, has purchased a six acre factory site at Seven Mile Road and Grand Trunk Railway, in the northeast section of the city, and begun construction of $150,000 plant on the property. Edward N Leftwich, vice president of the corporation, who made the announcement, said the new plant was necessary "to increase production and keep pace with the industry.

"Although we have purchased six acres," Mr. Leftwich said, "our present plans call for use of only about one acre of the tract The building, construction of which was begun several days ago, will be 100 ft by 280 ft. and modernly equipped in every respect.

"Most of the building will be one story in height, although the 100 ft front, facing Townline Road, will be two stories in height to provide space for offices

"The building now under construction will be the first unit of a much larger plant contemplated For approximately the first year after its completion it will be used as an assembly plant only. The bulk of our machine work will continue to be done in our present plant at 4042 West Jefferson avenue."

As a part of the initial unit, Mr Leftwich said, the company will construct three small buildings, apart from the main structure, to be used for "test shacks." Each building will house two test blocks on which the engines will be tested for from 10 to 20 hr., then torn down to be inspected and rebuilt to be shipped. The Warner company expects to be operating the unit by May 1.

Curtiss Opens Detroit School

DETROIT, MICH.—More than 700 persons attended an inaugural entertainment program here recently staged by the Curtiss Flying Service of Michigan Inc. Speakers on the program included Edward S Evans, E. E. Kramp, Lieut. W. S Dawson and Dr W F Gerherdt. Lieutenant Dawson and Dr Gerherdt are in charge of the local Curtiss flying and ground schools, respectively Eight women are included in the enrollment of more than 100 persons beginning ground school work.

Supreme Building New Plant

WICHITA, KAN.—With present quarters outgrown, the Supreme Propeller Co of this city has started work on a new 100 by 100 ft. two-story brick factory building A night shift of 12 men was recently added to help meet the demand for the firm's air screws.

Lockheed Names Canadian Agent

LOS ANGELES, CALIF. — Commercial Airways, Ltd, of Alberta, Canada, has been announced as the first foreign distributor of Lockheed aircraft, according to Sam Breder, sales manager of the Lockheed company here. An initial order of three planes is scheduled for early delivery to the Alberta distributor Two other contracts for foreign distribution of Lockheed products on a much larger scale are said to be pending announcement at the present time

In addition to the above distributor, the Erle P. Halliburton Co., Duncan, Okla, has been appointed distributor for Oklahoma and Texas with an initial order of five planes.

Army to Graduate Large Class

SAN ANTONIO, Tex.—Eighty two cadets and four officers of the Regular Army, the largest class to graduate from the advanced flying school at Kelly Field since the war will receive their wings here February 28 Thirteen of the prospective students are from California and six from Kansas. Cadet Ramon Arias is from Panama.

Government Reports 3,689 Planes Licensed

WASHINGTON, D C.—There were 3,689 airplanes licensed and 1,964 identified by the Aeronautics Branch as of December 31, the Department of Commerce reports California has 801 planes either licensed or identified, New York, 558; Illinois, 464; Ohio, 315, Michigan, 305, and Pennsylvania, 285 The balance is distributed as follows Alabama, 14; Arizona, 18, Arkansas, 55 Colorado, 43, Connecticut, 52 Delaware, 13, Dist. of Col., 57, Florida, 70, Georgia 57, Idaho, 7, Indiana, 145, Iowa, 112, Kansas, 156, Kentucky 31, Louisiana, 65, Maine, 13, Maryland, 63; Massachusetts, 119, Minnesota, 145, Mississippi, 13, Missouri, 261, Montana, 45, Nebraska, 88, Nevada, 6, New Hampshire, 13, New Jersey, 120, New Mexico, 7, North Carolina, 59, North Dakota, 27, Oklahoma, 160, Oregon, 43, Rhode Island, 24, South Carolina 20, South Dakota, 34, Tennessee, 52, Texas, 277, Utah 22, Vermont 5, Virginia 62, Washington 136, West Virginia, 30, Wisconsin 155, Wyoming, 12, Alaska, 12, Hawaiian Islands, 5, Canada, 1, Cuba, 1

Orders 33 Stinsons

SYRACUSE, N. Y.—As co distributor for the State of New York for Stinson planes, working in conjunction with F. H. Taylor, Inc., of Watertown N. Y., contracts have been signed by General Aviation Co., Inc., in Buffalo Utica, Albany, Syracuse and Watertown for a total of 33 Stinsons for the year 1929

Two Concerns Plan Flying Ambulances

CHICAGO ILL.—John W Henney, president of the Henney Motor Co of Freeport, Ill, announces here that his company and the Great Lakes Aircraft Corp of Cleveland have completed plans for an airplane ambulance and that production of the machines would be started in the near future The decision to manufacture airplane ambulances was made following inquiries for some mode of fast transportation for emergency cases to medical centers like the Mayo Brothers clinic at Rochester Minn, and from small towns to larger cities for expert surgical attention

The airplane ambulance cabin will be six feet wide, 10 ft. long and five feet high with accommodations for a nurse, interne, a wheeled cot for the patient, and two pilots or one pilot and an extra passenger It will have hot and cold running water, an electric fan, and ample drawer space for medical supplies instruments and linen

The flying ambulance will be an adaptation of the Martin Navy bomber planes produced by Great Lakes Aircraft Equipped with a Pratt & Whitney Hornet engine and special gasoline tanks, the flying ambulance is to have a high speed of 125 m.p.h and a cruising radius of approximately 1,000 mi, Mr Henney states

Health Service Gives Aircraft Regulations

WASHINGTON, D C—Aircraft plying between this country and its possessions and foreign points are affected by the following provision adopted by the Public Health Service

Any vessel or aircraft clearing from or leaving any foreign port or place or from any port or place in the possessions or other dependencies or the United States for a port or place in the United States or its possessions or other dependencies shall be required to obtain a bill of health, in duplicate, signed by the proper officer or officers of the United States as provided for by law, except as provided for in paragraph 3 (of the Regulations), and further provided that aircraft may be exempted from obtaining said bills of health except during the prevalence of any of the quarantinable diseases at such foreign port or place, or at such port or place in the possessions or other dependencies of the United States

To Handle American Eagles

FORT PIERCE FLA—Location here of the state distributorship of the American Eagle Aircraft Corp., Kansas City, and proposed establishment of a flying school, is announced by Howard Richards of this city, and Bert Krueger of Stuart. Mr Richards is a former employe of the American Eagle Aircraft Corp, while Mr Krueger has been a licensed pilot for some years

F. H. Russell to Head Curtiss-Caproni Co.

NEW YORK N Y—Announcement is made here of the appointment of Frank H Russell, vice president of the Curtiss Aeroplane & Motor Co., as president of the newly formed Curtiss-Caproni Co.

In 1909, Mr. Russell was named first manager of the Wright company, in 1911 he was made manager of the Burgess airplane firm, and when the latter merged with the Curtiss Engineering Co, Mr Russell became a director of the last named organization With the formation of the Curtiss Aeroplane company, he was made vice president in charge of sales

In addition to Mr Russell other officers of Curtiss-Caproni include Capt Thomas B. Doe, vice president, J A B. Smith secretary, John Sanderson, treasurer, Mr Keys, chairman of the executive committee, and Mr Caproni, chairman of the board. Listed among directors are J Cheever Cowdin, C W Cuthell, A O McDonnell, C Roy Keys, James C Willson, Effingham B Morris, Jr, Robert C Stanely, Mario Calderara and Carl C Conway

Gardner Trophy Race Committee Announced

ST LOUIS, MO—The contest committee for the Gardner Annual trophy race to be held at Parks Airport May 28 30, has now been named as follows

Oliver J. Anderson, John H Armbruster, Victor J. Azbe, P De C. Ball, Hubert Beal, Harold M Bixby, August A. Busch, Stanley Clarke, E L. Cord, William C D'Arcy, Col Halsey Dunwoody, James L. Ford, Jr, Frederick D Gardner, Harry Hall Knight, John G. Lonsdale, W. Ray Loomis, J. A. Love, Philip R. Love, L. D. Manning, Jr, Lieut. Col. John A. Paegelow, Oliver L. Parks, G Edwin Popkess, B Russell Shaw, Arnold G Stifel, T Preston Sultan, Maj C Ray Wassall, Walter B. Weisenburger, and J Gates Williams

Harry P Mammen president of Parks Aircraft, Inc. and Parks Air College, Inc, will be race director Mr Sultan will be chief referee and E Roy Alexander will be race manager Race headquarters have been established in the Missouri Theater Building

Study Acoustic Altimeter

LOS ANGELES, CALIF—Following award of a $2000 fund by the Guggenheim Foundation, experiments are being conducted with a new type altimeter using the acoustic method and being developed by Prof. L P Delsasso University of California, here. Professor Delsasso is the inventor of the ocean depth finder of acoustic type which is now being extensively used by the Navy The experiments financed by the Guggenheim fund are being conducted in the hope that this system will prove practical for determining the true altitude of aircraft above the surface of the earth

Holley Buys Kinner Interest

GLENDALE, CALIF—A substantial interest in the Kinner Airplane and Motor Corp, this city has been acquired by George M. Holley of Detroit, Mich, Kinner officials announce. Mr Holley is president of the Holley Carbureter Co, president of the Towle Marine Airplane Co, and a director of the Stinson Aircraft Co, all of Detroit He has now been named a Kinner firm director

Pioneers Sold P. A. A., Curtiss and Japanese

BROOKLYN, N Y—Curtiss Fledglings will be equipped with Pioneer navigational and engine instruments as standard installations, according to an announcement made by the Pioneer Instrument Co. The standard equipment will include a magnetic compass a tachometer, altimeter, air speed indicator fuel pressure gauge and oil pressure gauge. The tachometer, air speed indicator and altimeter will be installed in the new uniform sizes recently developed by Pioneer

Another announcement from the Pioneer Instrument Co states that navigational instruments manufactured by that firm have been accepted as standard equipment on all planes used by the Pan American Airways, Inc.

Also orders for two shipments of aeronautical instruments to Japan have been filled These included 30 earth inductor compasses fitted with double steering indicators for installation in dual control planes and 200 fuel level gauges specially adapted to the fuel tanks used in Japanese aircraft

Test Invincible Cabin Plane

MANITOWOC, WIS.—Two recent test flights here of the Invincible Metal Furniture Co.'s new plane proved successful. The craft a cabin monoplane powered by a LeBlond 90 seven cylinder engine, was piloted by William Williams and carried as passenger Irl Beach designer and builder This machine together with another plane now nearing completion, will be exhibited at the Detroit show

The Invincible company is at work on other aircraft models one of which is a sport monoplane. This machine will be of smaller type and less expensive than the cabin monoplane

Insulation Order Placed

NEW YORK, N Y—That its recently acquired subsidiary, the Molded Insulation Co of Mount Vernon, N Y, has received orders for complete ignition switch equipment from the Curtiss Aeroplane & Motor Co, Buffalo N Y for installation in 100 planes, is announced by the Consolidated Instrument Co, this city

Miami Firm Plans Amphibian

MIAMI, FLA—Announcement was made recently of the formation of the Miami Aircraft Corp to manufacture in Miami an amphibian monoplane

Detroit Concern Producing Parts

Aircraft Products Corp. Supplies score of Manufacturers

DETROIT, MICH— The Aircraft Products Corp., manufacturer of "Oil-Draulic" shock struts, tail wheels and landing wheels, organized in Detroit less than 10 months ago now produces standard parts for more than 20 of America's leading aircraft manufacturers it was announced recently by Ralph R Irwin, president of the corporation.

"Our products have been so well received, "Mr Irwin said "that our February production will total at least 200 sets of struts, 150 sets of tail wheels and 62 sets of landing wheels.

"Among planes using our equipment are those made by the Fairchild Aviation Corp, Sikorsky Aviation Corp., Gates-Day Aircraft Corp Pitcairn Aviation, Inc, Parks Aircraft Co., Curtiss-Robertson Airplane Co., American Eagle Aircraft Corp, Stearman Aircraft Co., Mono-Aircraft, Inc., Driggs Aircraft Co., Travel Air Manufacturing Co, Cessna Aircraft Co., Chance Vought Corp, Bellanca Aircraft Co, Verville Aircraft Co, Stinson Aircraft Corp, General Airplane Corp, Aircraft Development Corp, Simplex Aircraft Corp, Swallow Airplane Manufacturing Co., Swift Airplane Co., and the Kari-Keen Manufacturing Co

Makes Variety of Models

The Aircraft Products Corp. manufactures three models of shock struts, three sizes of landing wheels and two sizes of tail-wheels The wheels and their brakes are produced through an association with the Wire Wheel Corp of America, Buffalo, N Y and the Midland Steel Products Co, Detroit. Robert S. Gans, is vice president and treasurer, of the organization, A. J. Levin, secretary, and J H. Mozni, chief engineer, it is announced.

Lady Heath Says One Way Enough

NEW YORK, N. Y.—Before a somewhat weather scarred light plane at the New York Aviation Show a card was placed reading, "This is Miss Earhart's Plane. Lady Heath Flew It From London to Capetown and Return. Miss Earheart Flew It From New York to the Pacific"

A day or so passed Then visitors to the exposition noticed that the previously unmarked and unsullied example of the sign painter's art bore pencil marks — the words 'and Return' had been crossed out! . . . Closer examination revealed handwriting: "One way was enough! Sorry—J M Heath."

Production to Follow Approval by Klemin

PORTLAND, ORE.—Active production of a two-place training biplane will be started in or near Portland within the next six or seven weeks by Aircraft Builders, Inc., as a result of approval of design of the plane by Prof Alexander Klemin, of the Guggenheim School of Aeronautics J Kegerreis, managing director of the company, made the announcement upon receipt of a telegram from Norman J Normile, his representative in New York

Plans for manufacture of planes by the company were announced some time ago to start early in 1929 at a factory to be constructed in Eugene, Ore A temporary factory will have to be used, however, Mr Kegerreis said, in order to get a quick start on production Orders for 90 days' output have already been received, it is declared.

The plane will be known as the "Student Prince." Lieut. Basil B Smith, engineer for the company, well-known pilot and former instructor in the Rankin School of Flying in Portland, is designer of the craft. He is building the first plane in his machine shop

The model will be especially designed for use of a LeBlond 90 hp engine, but a Warner Scarab, or other engine of similar power may be used, according to Mr Kegerreis.

Lieutenant Smith is working on designs for a small monoplane which will be introduced after the biplane It will be known as the "Aerocrat" Lieut George E Love is president of the concern.

Merrill Will Produce Novel Type Airplane

LOS ANGELES, CALIF—Prof A A. Merrill, for several years in charge of aeronautical research work at the California Institute of Technology, has resigned his post there in order to devote himself to the manufacture of Merrill type airplanes A group of financiers in the East have provided funds for the establishment of a factory at some eastern city

Professor Merrill is the inventor of the tail-less, stagger decalage biplane which was recently successfully flown during the 1928 National Air Races at Mines Field. This craft has wings of adjustable incidence, and in climbing or descending, the wings are tilted allowing the body of the plane to maintain an approximately level condition

New Plant Finishes Bach

LOS ANGELES, CALIF.—Successful test flights have been conducted on the first Bach plane to be completed in the new factory, located at the Los Angeles Metropolitan Airport. This is the first of 50 tri-engined planes scheduled for completion during 1929, according to the announcement of George R Bury, general manager The Bach is a 10 place transport monoplane powered by one Pratt & Whitney Hornet and two Comet engines

Has Three Plane Agencies

NEW YORK, N. Y.—Rodabee Aircraft, Inc., has been formed with offices at 5 East 57th Street, New York City, and with flying headquarters at Curtiss Field, L. I. Capital, originally put at $50,000, may be increased, it is stated The firm, organized by Lea W Rockwell, Harry I. Day and Frederick Becker, will handle Stinson, Arrow Sport, and Laird plane sales in Metropolitan New York, Southern New York State, northern New Jersey, and Connecticut

Russell 'Chute Plant Facilities Expanded

SAN DIEGO, CALIF—Tripling of present plant facilities is necessitated at the Russell Parachute Co., this city, following the large Army Air Corps contract for several hundred 'chutes announced last week according to H. E Morin, aviation department, San Diego Chamber of Commerce

The parachutes will be of the standard Army type For their manufacture two tons of silk, 500,000 ft of silk cord, 25,000 ft. of webbing, 200 lbs. of silk thread, and more than 1,500 yds of ducking will be required, according to H. R. McClintock, president of the Russell company

The parachute firm has just completed a war department contract for 1,000 30 ft anti-craft tow targets These have been accepted by Government inspectors and are now being shipped to Army Air Corps units based throughout the United States, Panama, Hawaii and the Philippines

New Type Certificates

WASHINGTON, D. C.—Approved Type Certificates have been granted as follows

103 Curtiss Falcon, Liberty engine.

104 Mahoney-Ryan B-3, six place, dual control brougham.

105 Swallow two place training plane,

107 New Standard Model D-24, five place Hispano Suiza engine, sesquiplane.

108 New Standard Model D-25, same with Wright J-5 engine.

109 New Standard Model D-26 three place mail plane, Wright J-5

110 New Standard Model D-27, single place cargo carrying plane with Wright J-5

The following engine certificate has been issued 16. Floco seven-cylinder radial air cooled, developing 115 hp at 1800 r.p.m., product of the Axelson Machine Co., Los Angeles, Calif.

The Swallow Airplane Manufacturing Co started work on a large number of orders for the training plane, between 400 and 500 of which were received during the Chicago show, on receipt of notification of the Department of Commerce approval

The Mahoney-Ryan company is producing its new brougham and has ordered 250 Wright J-6 engines of 300 hp for installation in the new series

Senate Passes Flying School Rating Scheme

WASHINGTON, D C—Examination and rating of flying schools by the Aeronautics Branch in the same manner it supervises other departments of aviation activity advanced one step further recently when the Senate passed the bill giving the Department of Commerce authority. The bill fulfills a need not forseen when the Air Commerce Act of 1926 was drawn up

Both Houses of Congress have been working on the Army and Navy appropriation bills. The sum of $31,645,000 has been set aside for continuing the Navy's five-year aviation program About $600,000 of this is for increasing training facilities at Pensacola

Believing that the proposed allocation of supervision of the aircraft industry in California to the state motor vehicle department would create dual control of the industry with the Aeronautics Branch, hundreds of pilots and operators have joined in a state-wide campaign against the legislation due to come up soon

Warning lights must be placed on all radio towers in Nebraska projecting 50 ft. or more above the ground, if legislation now pending is passed

Statement is Issued About Advertisement

Editor's note—The following communication relative to an advertisement has been received from Malcoln D. Whitman, vice president of William Whitman Co., Inc Mr Whitman is also president of the Nashawena Mills, manufacturer of Nashawena airplane fabric

"Our attention has been called to an error in our advertisement relating to Nashawena airplane fabric, this advertisement appearing in the November 24, 1928, issue of "Aviation." We wish to correct this error as it is the intention of this company to be accurate in all statements issued in its behalf, whether in the form of advertising or otherwise

"We were among the pioneers in the development and construction of airplane fabric in this country, our representatives conducting many experiments in our own central laboratory, in the mills and in conjunction with the Bureau of Standards in Washington

"During the war period we took orders from the Government for more than 34,000,000 sq. yd of various fabrics, and in the tabulation of these orders an error was made in the total yardage of orders for airplane fabric taken in behalf of the Nashawena Mills, and this error was transcribed by us into our advertisement and published before it could be caught by the management The statement was true in substance though inaccurate in amount, for while we actually took orders for several million yards of airplane fabric, the total was less than 10,000,000 yd., the amount stated in the advertisement.

We wish you would have this error corrected in your publication and we furnish this information accordingly"

Insurance Agents Named

NEW YORK, N Y.—Barber & Baldwin Inc., this city, announce that Rule and Sons, Inc., Los Angeles, has been appointed general agents for the Aero Insurance Co and the Aero Indemnity Co. for California. Rule and Sons, Inc, has for some time been making a specialty of aviators' insurance and is in a position to give strong and experienced support to all licensed brokers and sub agents of the Aero companies throughout the state

Personnel

GEORGE BASSETT recently was elected a member of the board of directors of the Swallow Airplane Co to succeed VICTOR H ROOS who is now connected with the Lincoln Aircraft Corp HENRY ROSENTHAL has resigned from the board

EUGENE CANNAVA, architectural engineer, has been added to the staff of William H Hallin, Inc, New York City, designers of airport buildings.

L. G MASON formerly of Sharon, Pa., has been appointed manager of the new Municipal Airport now being constructed at Montgomery, Ala. In addition, he is establishing under his own supervision the Montgomery School of Aeronautics.

J BERTRAND PURNELL, formerly of the Longview Flying Field, Latrobe, Pa., has been appointed chief pilot and instructor of the Montgomery School of Aeronautics.

R. W WHITNEY, Army flying instructor during the war, has joined the staff of the Aeronautical Chamber of Commerce as junior executive

EBLE H. SMITH, sales promotion manager of the American Eagle Aircraft Corp., is to have charge of the company's advertising section, also

CHARLES J ERNST has joined the staff of Black & Bigelow as architect in charge of design of hangars, airport waiting rooms and other airport buildings

LIEUT JAMES ELLISON, commander of the military unit at Bowman Field Louisville, Ky., will head the committee arranging the air display during the national American Legion convention in that city next fall

ALLAN A. TUKEY was re-elected president of the Omaha Legion Airport Corp at a recent meeting HUGH STRYKER and LEO BOZELL were elected vice presidents, T A LIESEN treasurer, CLINTON BROME, secretary These and FRANK LANDERS and E W DEVEREUX constitute the board of directors

EDWARD A. SIPP, who has been in charge of lighting development for airports and aircraft at the Army Engineering Division at Dayton, O., has been placed in charge of similar work and sales engineering for the Pyle-National Co of Chicago

JOHN E. ALEXANDER recently was re-elected president of the Tri-City Airways, Inc., of Wisconsin Rapids, Wis The other officers re-elected include ISAAC P WITTER, vice president G. D FRITZSINGER, secretary-treasurer, E. P GLEASON, engineer, and CHARLES E. BRIERE, L. P DANIELS and G O BABCOCK, directors

W. B HAVILAND commander in the Navy during the war and a member of the Lafayette Escadrille, has been elected director of Universal Aviation Schools of the Universal Aviation Corp

C. A. BEALKMAN, former inspector for the Department of Commerce, has resigned to become assistant general manager of the Swallow Airplane Co of Wichita, Kan

BENNY GROULX, veteran parachute tester and jumper of the Thompson Bros. Balloon & Parachute Co., Aurora, Ill., is to retire at the close of the 1929 season.

N. T PULSIFER and A. L. PHILLIPS respectively chairman of the board and executive committee and chairman of the board of directors respectively, of Valentine & Co

H. B. RUSSELL, pilot of the Standard Airlines, Inc., is in charge of personnel of the company stationed at the Phoenix, Ariz, terminal of the new air-rail service.

C. G PETERSON, formerly with the Wright Aeronautical Corp and organizer of the Aerial Advertising Co., recently has been appointed sales manager of the Metal Aircraft Corp of Cincinnati, O

WOODFORD BAXTER has been appointed resident manager of the Kentucky Airways Operators, municipal airport, Lexington, Ky.

LIEUT ALEX HOLDEN, veteran of the Royal Flying Corps war service, has been elected president and general manager of Washington Aeronautical Corp., Tacoma, Wash

WILLIAM KELSEY, JOHNNY MARTIN, DELBERT EVERETT and H. J. KELSEY, all of whom are transport pilots credited with more than 1,500 hr., have been added to the staff of Standard Air Lines.

FRANK H. HITCHCOCK, former postmaster general and during whose administration Earl Ovington first carried the air mail, has acquired a substantial interest in Standard Air Lines of California and is a member of the board of directors

MARK HURD, head of the Minneapolis school of the Universal Flying School group, has been transferred to St. Louis in charge of company sales He is succeeded by V J. JONES FLOYD HOCKRIDGE, manager of the St. Paul school has been transferred to St Louis, his successor being FRANKLIN ARMSTRONG.

E. H VESLEN, P SWANSON and RICHARD HAPP, graduates of the Minneapolis branch of the Universal Flying Schools, have been named co-pilots on the Minneapolis-Chicago run of Universal Air Lines

GEORGE O MILES has been appointed office manager of Northwest Airways, Inc., in charge of Chicago, Milwaukee and the Twin Cities offices.

CARL S CLARK, recently was announced general manager of all activities of the Western College of Aeronautics at Los Angeles, Calif There are said to be 160 students enrolled at the school under a faculty of 11 instructors

Trade Tips

It Has Been Reported That—

—Establishment of nine more airports is planned, the fields to be at the following cities Newport Beach, Calif, Marlboro, Mass., Paducah, Ky., Roswell, N M, Belen, N M, Denmark, S C., Andrews, S C., Columbia, S C., and Thomas, W. V

—Hugh Watson, president of Watson Airport, Cincinnati, has completed plans for an additional hangar, to house 10 planes, at his field Plans for a club house to contain rest rooms for passengers, a cafe, and a dormitory for flying students have also been approved.

—Universal Air Lines System, now operating mail out of the Watson port, will also construct a huge hangar at the field this spring, it is announced. This structure is to house the large Fokker planes being placed in passenger service

—The Yunkers Aircraft Corp., Dodge City, Kan., of which George Yunkers is president, is reported to be planning the erection of a $35,000 airplane factory in St Louis, Mo.

—The Von Hoffman Flying School will erect two hangars and a barracks to accommodate 100 students at the Lambert-St Louis Flying Field, Anglum, Mo The cost of the new structures will be about $35,000 Albert Von Hoffman is president of the company.

—W. I. Saul, L. R. Chapman, and R W Humphrey are interested in the organization of a company to establish an airplane factory at Carroll, Ia., to cost about $125,000

—Bids will be opened February 18 for a building to cost in the neighborhood of $4,000, to house radio and meteorological apparatus which the Government will install at Fly Field, Yuma, Ariz. The structure must also contain sleeping accommodations for the signal corps men who will be detailed to the field.

Foulois to Lead Big Air Parade

WASHINGTON, D. C.—Brig. Gen. Benjamin D. Foulois, Assistant to the Chief of the Army Air Corps, will lead a combined Army and Navy aerial review of both heavier and lighter-than-air craft as a feature of the Presidential Inaugural Parade here March 4. Comdr C E. Rosendahl, U S N., commanding the naval air station at Lakehurst, N. J., will direct the activity of the lighter-than-air craft participating. The dirigible Los Angeles will probably lead this group.

BRIEFLY—

Rear Admiral J M Reeves or Rear Admiral A. W Marshall, commanders of the air squadron and the air scouting fleet, respectively, probably will be named to succeed Rear Admiral W A Moffett as chief of the Navy Bureau of Aeronautics.

Stout D and C. Lines, Inc, has been organized at Buffalo by the Stout Air Service and the Detroit and Cleveland Navigation Co for the operation of a flying boat service between the two cities this summer Two European planes have been ordered

Objection has been made by E. P. Lott representing the N A T., to the Post Office Department relative to the use of Newark airport as an air mail field which he claimed unsuited to operations scheduled to start February 17

An airplane is not a motor vehicle and the theft of an airplane, therefore, cannot be tried, according to Judge J P Henderson of North Carolina. The case hinged on whether or not a plane could be classed as a motor vehicle under North Carolina law

Twenty three of the mail routes carried 475,931 lb of mail in January, according to a preliminary report of the Post Office Department. This was an increase of 331,642 lb over the volume of January, 1928

Humidity and temperature as well as altitude of a plane in flight are recorded by the aerograph recently tested at Hadley Field, N J, which is expected to afford pilots a better knowledge of weather conditions along the route.

A complete airport handbook giving information about government ratings and airport buildings construction is being issued by the National Lumber Manufacturers Association in a revised edition.

Universal Flying School plans to expand its activities to include Kansas City, Mexico City and Dallas, Tex, and other mid-western cities, according to J G Lamb, general sales manager of the schools

Delivery was taken recently on a new Travel Air powered with the 150 hp. radial Axelson engine by M J Parker pilot of the Axelson Machine Co. of Los Angeles

Breese Aircraft Corp has been organized in Portland Ore., to take over manufacture of the Breese monoplane now being built in San Francisco. Equipment and unfinished planes will be moved to the Portland plant at once.

Pacific Airplane Service has been changed to Eyerly Aeronautical School Lee U Eyerly has completed construction of a monoplane according to his design with the exception of mounting the engine

Maddux Air Lines carried 11,806 passengers last year, the planes flying 3,145,685 passenger miles, 88 per cent. of which were run on scheduled trips.

Master Aeronautical Corp. of Grand Forks, N D, is briskly turning out propellers, it is reported Planes in the vicinity use this air screw, and orders from outside buyers are now coming in

Phoenix Aircraft Corp of Phoenix, Ariz., expects to produce its first all-metal monoplane, powered with Velie engine, soon

Acme Aircraft Corp planes of Rochford, Ill, will be distributed in Rockford by Fred E. Machesney, pilot manager of the Rockford Airport. The machine is powered with a Velie engine

Two officials of the Stinson Aircraft Corp, William A Mara and Randolph G Page, recently completed a round trip business flight to Mexico from Detroit using a Stinson Junior

Six American Eagles have been ordered by the Empire Airways Co, newly appointed Santa Rosa, Calif., dealer.

A special section devoted to airport architecture will be found at the Architectural and Allied Arts Exposition to be held in April at the Grand Central Palace, New York City

Objection to the application of the proposed gasoline tax in the instance of airplanes was voiced at the New York State Aviation Conference held at New York last week

Passing of an examination to be held at Bolling Field Anacostia D C, the week of March 18 will make citizen fliers eligible for appointment as second lieutenants in the Army Air Corps

Offices and shops of the Goodyear Zeppelin Corp have been moved to a new home in the rim plant of the Goodyear Tire & Rubber Co, Akron, O.

Dr M Lyle Spencer, president of the University of Washington, has issued orders for John Graham campus architect, to proceed at once with the detailed plans, for the Guggenheim aeronautics building planned.

A total of 1760 flights and landings with some 3 003 passengers is recorded for the month of January at Mills Field the San Francisco airport This is a substantial increase over December 1928, and a gain of more than 100 per cent over January a year ago

Parmenter Flying Service Corvallis Wash. has been named local dealer for the American Eagle under the Mackenzie-Morrow Aviation Co of Portland Ore.

Cotton-Textile, Institute, Inc, New York City, announces development of a fabric airway marker said to be both economical and practical for nation-wide use

Sale of an all-steel hangar, 80 by 60 by 14 ft. with inside sliding doors, to the city of Burlington, Vt., is announced by the Esline Company, Milwaukee, Wis, through its New England distributor, Vermont Airways Corp., Newport, Vt

F L Hale of the Curtiss Flying Service is at Omaha Neb, making a survey in that vicinity for the possible establishment of one of that company's school, sales and service branches

According to Sumner Sewall, traffic manager for the Colonial Airways system, that firm's lines carried a total of 25 487 lb. of mail in 53 159 mi of flying during January Colonial Western Airways showed an increase for January of 452 lb over the December mail total

Claude Neon Lights, Inc., has issued a booklet describing various devices for illumination of airports.

New Firms Announced

Great Western Air Lines, a Los Angeles corporation with capitalization of $3 000,000 has been organized to establish passenger and freight service radiating from Los Angeles.

Invincible Air Craft Corp, capitalization $500 000 is being formed through the Invincible Metal Furniture Co, Manitowoc Wis Planes will be produced, the initial model having been turned out.

Aero Motors, Inc. has been chartered at Portland, Ore for the production of aircraft power plants Capitalized at $500,000, the firm has been organized by Thomas Bilyeu, Robert B. McElroy, and Robert C Jackson

Lear Aircraft Co has been chartered with a capital of $50 000, at Wichita, Kan, to manufacture a small plane using Velie power With Claude Lear, designer, are associated Arch Lear and Charles Kelly

Airways Transport, Inc, has been formed at Fort Myers Fla., with capital put at $25,000 C F Wheeler, R. E Kurtz and others, are associated in the project

Century Aircraft Corp has been chartered in Kansas City, Mo, with a capital of $15 000, to manufacture and sell airplanes Organizers are F E. Wilcox Ray W Wilcox Archie F Siegling, and R. H Brainerd

Western Dusters is the name of a firm formed for dusting in the Southern California orange grove region An OX-5 Thunderbird W-14 was used in initial tests recently conducted

Major Livingston Irving Aviation Activities, Inc., has been organized at Oakland, Calif, to conduct a school, offer flights and aid in the distribution of Eaglerock airplanes Branches are to be established at other Pacific Coast cities

Wisconsin Air Lines Inc. has been formed at Kenosha Wis, by Lieut Hart G Smith, Floyd D Bayless, and E. M Smith A full program of aeronautical activity is planned, including the rebuilding and repair of aircraft

AIRPORTS AND AIRLINES

Detroit Airports Plan for Guests

Accommodations for 5,820 Planes Prepared for Show Visitors

DETROIT, MICH—In order to make Detroit the focal point of American aviation during the second annual All American Aircraft Show, to be held here April 6-14, city officials and officers of the Detroit Board of Commerce, sponsors of the exposition, have taken a number of ambitious steps toward attracting one of the greatest assemblage of aeronautic figures and airplanes ever before seen in one city

Following a survey of Detroit area landing fields conducted by the Board with the cooperation of Detroit city engineer's office and the U S Department of Commerce, Edward S Evans, chairman of the show committee, has sent letters to 5 500 airplane owners, representing practically every plane owner in the country, inviting them to fly to Detroit for the Show

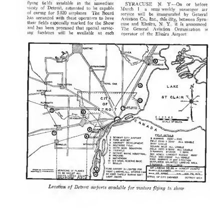
The survey revealed that exclusive of Selfridge Field, there are 11 airports and flying fields available in the immediate vicity of Detroit, estimated to be capable of caring for 5 820 airplanes The Board has arranged with these operators to have their fields especially marked for the Show and has been promised that special servicing facilities will be available at each field The fields with their respective, accommodation capacity, are as follows: Ford Airport, 1 000 planes, Detroit Municipal Airport, 1,000 planes, Aircraft Development Corp. Field, 500 planes, 107th Observation Squadron Field, 20 planes, Triangle Flying Service Field, 600 planes, Stinson Aircraft Field, (Northville), 500 planes, Stinson Aircraft Field, (Wayne Industrial Airport), 500 planes, Packard Field, 700 planes, Mathewson Field, 600 planes, and Scolly Airport 400 planes A large number of amphibians seaplanes and flying boats can be accommodated at the U S Naval Reserve base on Grosse Isle and other spots along Detroit's water front.

John C. Lodge Mayor of Detroit, and grand uncle of Col Charles A Lindbergh has proclaimed the week of the Show as "National Aviation Week" S. Wells Utley, president of the Detroit Board of Commerce, has mailed letters to 1,500 chambers of commerce throughout the United States, inviting them to send delegations to the Show.

Thus far more than 85 airplanes have been entered and the list of accessory exhibitors is hovering close to 100 The Show will be held in Convention Hall, where it took place last year.

General Aviation to Start Line

SYRACUSE N Y—On or before March 1 a semi weekly passenger air service will be inaugurated by General Aviation Co., Inc., this city, between Syracuse and Elmira, N Y. it is announced The General Aviation Organization is operator of the Elmira Airport



Location of Detroit airports available for visitors flying to show

Ft. Worth-Dallas Line Opens Soon

Oklahoma Firm to Start Passenger Service About March 1

OKLAHOMA CITY, OKLA—Opening of air passenger service between St. Louis, Tulsa, Oklahoma City, Fort Worth and Dallas is tentatively set for March 1, according to Erle P Halliburton of Duncan, president of the company organized in Oklahoma for operation of the line.

Five 14 passenger Wasp powered Ford planes have been ordered for use on the line, Mr. Halliburton said. Three of the planes are to be delivered during February, two during March.

The $1,000 000 company which will operate the line is composed for the most part of men interested in the oil business W. G Skelly, Harry Rogers, Pat Hurley, J C Halliburton, Robert Garland, Waite Phillips and E. H. Moore, all of Tulsa, and others are financially interested.

Later extension of the line westward from Oklahoma City by way of Wichita Falls, Midland and El Paso, Tex., and Turson, Ariz., to Los Angeles, is planned Kansas City also is to be made a stop by development of a spur line.

Daily service each way is to be given by the new airline. Planes leaving Dallas and St Louis will arrive at the other end of the line six hours later, according to the schedules prepared. Morning departure and 2 o'clock arrival are planned.

Mr Halliburton is the owner of the Wasp Lockheed Vega which Robert W. Cantwell piloted to first place in the transcontinental air races, Class C 1928

Install Lunken Airport Lights

CINCINNATI, O—With the contract awarded to the Archiable Electric Co., this city, work on the illumination of Lunken Airport is now under way. The lighting system is to cost $7 850 C O Sherrill city manager, reports that hangar, repair shop and a protective dike are also under construction.

Would Improve Roosevelt Field

LONG ISLAND N Y—Plans for development of Roosevelt Field, L I into a complete airport with the expenditure of $1,500,000 and the erection of many buildings and airport accessories were reported here recently

Ford Air Lines Report Activities

Freight Transports Carried 1,663,120 lb. of Goods During 1928

DETROIT, MICH—Reports of the Ford air lines on operations during the year 1928 discloses that Ford freight planes, running on regular schedule for business purposes by the Ford Motor Co, transported 1,663,120 lb of goods over 278,943 mi. in 3,198½ flying hours during that period. Since the lines were inaugurated on April 13, 1925, these aircraft have flown 1,060,175 mi on scheduled trips.

The 1928 operations figures, taken with previous reports show that for nearly four years the Ford Motor Co has been making important air freight shipments between Dearborn, Mich., Chicago, Cleveland and Buffalo with such a degree of success that of the 2,333 flights scheduled, 2,225 or 91 1 per cent, have been completed

Figures for 1928, which are still tentative, show that 547,003 mi have been flown over the Chicago-Detroit route and 2,744,454 lb. of freight have been carried

On the Detroit-Buffalo route, established March 28, 1927, there have been 978 scheduled trips, of which 90 per cent have been completed Ford Freight planes carried 1,014,987 lb between the two cities and flew a distance of 213,264 mi

Other Figures

The Cleveland-Detroit freight line was discontinued July 19 1928, after having been in operation from July 1, 1925 During that period the air freighters covered 299,908 mi and carried 2 684,632 lb of freight

Of the 611 flights scheduled between Detroit and Chicago during 1928, 92 1 per cent. were completed On the Detroit Buffalo route 86.8 per cent of the 508 flights scheduled during the year were completed Between Detroit and Cleveland, 324 flights were scheduled prior to July 19, and 93 8 per cent. were completed.

W. A. E. Leases Hangar Space

OAKLAND, CALIF—Formal lease of hangar space at Oakland Airport has been contracted by Western Air Express, following a test period of six months The lease covers the eastern half of Hangar No 1, giving W A E a space 90 by 100 ft. plus office areas and shop facilities. It is to run one year, with privilege of renewal for two additional years

Wichita Lets Port Contracts

WICHITA, KAN—The Wichita board of park commissioners has let contracts for a hangar and apron for the new municipal airport, the total cost being $63,300 The board will furnish materials for the work and will supervise its construction

Mail Planes May Cut Birmingham

BIRMINGHAM, ALA.— City officials have been informed that if the city does not provide proper facilities for air mail planes, air mail service will be stopped.

It was pointed out that Roberts Field was too small and rough for the planes used by Gulf Airlines, operating C A M 23 Though officials have been talking of building a new municipal airport here for some time, little action has been shown.

Tampa to Get Air Mail

JACKSONVILLE, FLA—Air mail service between Tampa and Daytona Beach will be started March 1 by the Pitcairn Aviation, Inc, it is announced by Ralph S Westing of Philadelphia, director of public information for the Pitcairn Co. The route will lie over Orlando to Daytona, where the planes will connect with the airline between Atlanta, Miami and the West Indies

St. Louis Corporation Will Build New Airport

ST LOUIS, MO.—Conversion of a 42b acre tract of pasture land into a Class A airport on the outskirts of East St. Louis, in St Claire County, Ill, for the use of Transcontinental Air Transport, Inc., and the Curtiss Flying Service will begin immediately, according to announcement by the St. Louis Air Terminals, Inc., a corporation recently organized to carry out this undertaking

This new airport will be the St Louis stop of the T.A.T., on its coast to coast air-rail route, known as the "Lindbergh Line," and will be used by the Curtiss Flying Service as one of its 25 fields

Robertson to Use Army Field

OMAHA, NEB—Permission to use the landing field at Fort Crook has been granted the Robertson Aircraft Corp by the Dar Department. This corporation an operating division of the Universal Air Lines System holds the mail contract between Omaha and St. Louis and will start operating the new line within 60 days Passenger service will be included

Omaha Sub-Committees Named

OMAHA, NEB—At its recent second meeting members of the Civic Aviation Committee agreed upon four subcommittees These are Field development, A H. Fetters and Gould Dietz, lighting, J E. Davidson and Dr J A Tamisiea, building program, Col Amos Thomas and John McGurk, and plan of management, Dr Tamisica and Colonel Thomas.

Completing Terminal For Standard Lines

LOS ANGELES, CALIF—The new terminal depot and office building of Standard Air Lines is rapidly nearing completion at the Los Angeles field of the Aero Corporation of California. Expansion of the Standard Air Lines service to an air-rail hookup providing daily flights between Los Angeles and El Paso has made the increased terminal facilities necessary

By moving buildings on the south side of the runway approximately 200 yd farther south, 20 acres has been added to the available area of the field. The five individual hangars now south of the runway are being added to the 17 along the north boundary of the field. A total of 29 hangars will be available soon, following the construction of five individual hangars on line with the new passenger depot building, and two hangars, measuring 90 by 70 ft each, being erected adjacent to the depot, for storage of the Fokker Super-Universal and F 10 planes now in service on Standard Air Lines

The passenger depot and administration building contains 10 offices, switchboard for telephone connections, a large waiting room, public rest rooms, and a modern restaurant. The structure is of Spanish type with an arched arcade and stucco

Parks Airport to Have Headquarters Building

ST LOUIS, MO—With work already proceeding on a new hotel building at Parks Airport, in the St Louis Metropolitan District three miles south of East St Louis, contracts will be let for a new administration building, also to be erected on the field, according to an announcement by Oliver L. Parks, vice president and general manager

The administration building, like the hotel, will be of brick construction It will include class rooms an assembly room, administrative offices a cafeteria and a completely equipped photograph department for students in the new photographic course

Among other projects on the immediate building program for Parks Airport is a new school for airplane and engine mechanics for which plans have already been drawn The building is to be of brick and steel construction with windowed sides

Plans Night Passenger Line

LOS ANGELES, CALIF—Regular night flying service for passengers has been announced by the Mutual Aircraft Corp here through M B Rapp, president This concern has been operating a night freight service between Los Angeles and San Francisco since the summer of 1928. It is said that 68,511 mi of night flying, carrying a total of 67 tons of express matter have been completed without mishap Ryan Brougham cabin planes equipped with night flying lights and flares have been used exclusively

Airports and Fields Reach Total of 1,324

WASHINGTON, D C.—A total of 1,324 airports and landing fields exist in this country, according to the most recent report of the Aeronautics Branch They are classified as follows Municipal, 368, commercial, 365, auxiliary, 312, intermediate, 197, Army, 64, Navy, 16, Department of Agriculture and Interior Department, one each

California has 143, Texas, 101, Pennsylvania, 83, Ohio, 62, Illinois, 60, Oklahoma, 46, New York, 43, and Iowa, 38 The report stated that there are more than 4,000 other fields on which landings may be made These are unmarked and have no facilities and are owned by cities clubs, corporations, individuals and the like

Pennsylvania has 65 proposed fields, California, 60, New York, 60, Texas, 54, Ohio, 45, Michigan 45, and Illinois, 37 The latest added to this list are municipal projects at Newport Beach, Calif, Marlboro, Mass Paducah, Ky, Roswell, N M., Belen, N M; Denmark, S C., Andrews, S C, Columbia, S C., and Thomas, W. Va.

Oregon Sites Backed For Dirigible Bases

PORTLAND, ORE— Three Oregon sites for the proposed $5,000 000 Pacific Coast naval dirigible base are receiving backing of people in and near Portland Two are on islands in the Columbia River and, as their sponsors say, would be available for landing of both land and sea planes

The islands proposed are Sauvies Island, about 20 mi below Portland and Government Island north of Portland The latter contains about 5000 acres. The third site, backed vigorously by the Scappoose, Ore, Chamber of Commerce, is near Scappoose and as much land as is required is available

The Portland Chamber of Commerce has announced that it will call a conference soon to attempt to fix the effort for the air base on one site

Oregon Gets Emergency Field

ASHLAND, ORE—A 15 acre field nine miles south of Ashland has been leased by the government as an emergency landing field on the Seattle-San Francisco airway The airport will be equipped with a beacon and boundary lights The field is about 10 mi north of the summit of the Siskiyou Mountains, the highest point crossed by the air route A beacon will be placed on the summit

Cemetary May be Airport

NEW ORLEANS, LA—An ordinance which would authorize the establishment of an air field on the tract dedicated as "Roshill Cemetery," was recently introduced by Mayor O'Keefe in Commission Council The site, two miles from the heart of the city over paved streets, has not been used for a cemetery, save for the grave of one person

Plan Mexico Air Excursions

LOS ANGELES, CALIF—Special monthly excursion flights between Los Angeles and Mexico City have been announced by the American Aircraft Corp The trips are to be made in Fairchild cabin planes, the fare being $200 for the round trip including 30 day return limit and stop-over privileges at Mazatlan. For the round trip to Mazatlan only, a fare of $175 is charged The first excursion trip was scheduled for February 9-12, as we go to press, in order to permit attendance at the annual Mazatlan carnival and fiesta

Tucson, Ariz., to Make Airport Improvements

TUCSON, Ariz—Tucson's aviation program for 1929, as outlined by the local chamber of commerce, consists of providing boundary lights and service buildings for the municipal field here, improving runways, and eliminating dust from the field Tucson, first city in the state to provide lights for its airport is determined not to be outdistanced by Phoenix.

The chamber's air committee includes H H. Holbert, chairman of the city council's aviation committee Kirke T Moore "Grand-daddy of Arizona Aviation" and chairman of the state committee, R C Denny, president of the Flying Wildcats, Arizona U's flourishing air club, Hazen Henry, chairman of the Aviation Committee of the American Legion, Herbert C Chambers, Herbert G Wilson, Emerick Jones and Ralph Ellinwood

Airway Bulletins Completed

WASHINGTON, D C.—The Department of Commerce has completed and is publishing the following Airway Bulletins

501, Columbus, Ga., 502, Kilbourn, Wis, 503, Waynesboro, Va 504, Chowchilla, Calif, 505, Lancaster, Pa., 506, Livingston Calif, 507, Rochester, N Y, 508, Plantersville Ala. 509, Simpsonville, S C. 510 Stanley, N C., 511, Wheatley, Calif 512, Special Warning (Obstructions etc.), 513, Pierre, S D, 514, Cropwell, Ala, 515, Conway, Ark., 516, Phoenix, Ariz; 517, Wichita Falls, Tex 518, Providence, R. I, 519, New Castle, Pa.; 520, Quantico, Va., 521, Gastonia N C, 522, Orlando, Fla, 523, Fort Wayne Ind, 524, Philadelphia, Pa., 525, Cheraw S C., 526, South Bend, Ind, 527 Seneca, S. C.; 528, Portland, Me. 529 Keysville, Va.; 530, Coffeyville Kan 531, Chicago, Ill, 532, Los Angeles Calif.

New Orleans Port Renamed

NEW ORLEANS LA—The board of directors of the New Orleans Airport has adopted a resolution declaring that henceforth the aeronautical plant owned and operated by the commission near Belle Chasse on the outskirts of the city, shall be known as the "New Orleans Municipal Airport" The name "Alvin Callender" will continue to be used in reference to the landing field alone.

Northwest to Carry Passengers by May

MISSOULA, MONT.—W. R. Walker, owner and traffic manager of Northwest Air Way, Inc, announces that a passenger service operating independantly of the mail line, will be established by the first of May. There will be daily or twice daily passenger service between Butte, Helena, and Great Falls The passenger service now provided by the company's mail line then will be used merely to supplement the new facilities

At the same time it was announced by Mr Walker that plans are under way to extend the Northwest lines from Great Falls to Lethbridge, Canada, there to connect with lines of a Canadian firm operating from Edmonton to Calgary.

Construction of the new 100 by 150 ft $25 000 concrete and steel building at the new Butte airport is to start shortly The structure is to house a huge hangar, passengers' waiting room, engine repair shops, and offices. On its completion about May 1, four new planes are to be purchased A traffic and business office, furthermore, will be maintained later at Salt Lake City.

Wisconsin Lights About Ready

LA CROSSE, WIS—Operation of 15 beacon lights between here and the Twin Cities for night air mail planes on the Twin Cities-Chicago route by way of La Crosse, Madison and Milwaukee may be expected shortly W. A Stodts, airways mechanician of the Department of Commerce with headquarters at La Crosse, has announced. An emergency field at Winona has been fully equipped with the necessary lights for night flying and Mr. Stodts expects other fields at Wabasha and Red Wing to be fully equipped within a week.

Forms Pacific Coast Express

SAN FRANCISCO, CALIF—Formation of a new air express service reaching all important Pacific Coast points between San Diego and Seattle, and reduction of air express rates from 50 to 75 per cent., is announced by J. E. Casey, president of the United Parcel Service The new service is to be known as the United Air Express and will begin immediately, according to Casey All parcels for air transportation will be delivered to airports by the parcel company's trucks and carried by planes at contract rates. A 100 per cent increase in air transportation of express is expected by officials of the new company because of the rate reductions

FOREIGN ACTIVITIES

Curtiss-Reid Building Rambler Light Planes

MONTREAL, CANADA.—The Curtiss-Reid Aircraft Co, Ltd, this city, has about completed a number of its Rambler machines, two place light biplanes, powered with the Cirrus Mark II engine, for demonstration in foreign countries The plane is designed particularly for flying clubs, private owners and light commercial work.

The Rambler is a sesquiplane It is of metal throughout with the exception of the wing and fuselage covering, the fuselage being of seamless steel tubing welded into a solid unit The wing spars and ribs are of strong aluminum alloy

The tail plane, elevators and rudder are of seamless tubing, also. It is a single unit with the twin-elevators bolted together at the center of the machine where the cables are attached, and is supported from the fuselage by two streamline steel struts to stop flutter

The wheel track is six ft wide and the undercarriage embodies a special form of rubber buffer which is compressed under landing loads. Skis are interchangeable with the wheels

Gas feed is by gravity from a 20 gal. tank in the top center section plane. All oil is carried in the engine base Complete dual control and spring horizontal stabilizer adjustment are fitted Positive action bolts fitted to the front spars of the top and bottom wings permit folding by two persons in two min.

The specifications are as follows:

Length over all (open)	22 ft 8 in.
Length over all (folded)	24 ft 6 in
Wing span (open)	33 ft. 0 in.
Wing span (closed)	11 ft. 1 in.
Height	8 ft 0 in
Weight (empty)	850 lb
Gasoline capacity	20 gal
Useful load	595 lb
Total weight	1,445 lb
High speed	105 m p.h
Cruising speed	85 90 m p.h
Stalling speed	38 m p h.

Showing the Rambler with wings in flying position

Scadta Reduces Mail Fee

BARRANQUILLA, COLOMBIA.—Scadta system has announced a reduction in the air mail fee to any destination in this country to $1 per pound or fraction thereof The rate to cities in Ecuador is $1 50 per pound The minimum weight allowed has been reduced from 2 2 lb to 1 lb. Air mail now may be sent C.O D to certain Colombian cities Agencies of the company are in six United States and two Canadian cities

Lines Through Africa Planned by Europeans

PARIS, FRANCE.—A common airway connecting this country with Madagascar and Belgium with the Belgian Congo early in 1930 seems assured following a conference here between French and Belgian interests Belgium has been negotiating for permission to fly over French territory in northern Africa in operating its line to the Congo and since much of this route coincides with one proposed by France, cooperation has been suggested A Farman photographic plane is to be sent over the route for a survey.

In the meantime Imperial Airways and the Cobham-Blackburn interests in England are uniting in the development of a commercial service through Africa, starting with a Cairo-Cape Town line on the eastern side of the continent.

Wealthy Mexican Plans Line

MEXICO CITY, MEXICO.—The Amahuac Air Service of Mexico has been granted a 40 yr. franchise by the government for operation of a mail and passenger service between this city and Oakland, Calif, according to Carlos Alarcon, wealthy oil promoter and rancher of Lower California. Tri-engined transports are to be used The line will be started within four months

England to Emphasize Commercial Markets

LONDON, ENGLAND.—The trend of Europe away from heavy concentration on military aircraft toward development of commercial types suitable for local and world markets continues. Following closely on the recent agitation in France for better commercial machines, it is reported the English government is likely to increase the funds for commercial encouragement

It is significant that this probably will be taken from the amount usually allowed the R A F., a notable transfer of emphasis. The government plans a definite bid for the world aircraft market through production of multi-engined smaller feeder line, flying boat and amphibian types

French Buy 10 Fokkers

PARIS, FRANCE.—Ten Fokkers built in Amsterdam have been ordered by the French company which recently secured permission to side-step the French subsidy ruling and buy equipment made outside the country Seven of the machines will be powered with one Gnome-Rhone Jupiter each while three will have three Gnome-Rhone-Titans each

Foreign News Briefs

Conferences between Luft Hansa and two German shipping concerns relative to joint operation of a transocean flying company have not halted as rumor stated, according to Herr Merkel, but are proceeding satisfactorily

Van Lear Black, Baltimore publisher, has left Croydon on a flight which will take him to Cape Town and return and Tokio and return He is using his Fokker with three Whirlwinds and will bring the plane to this country eventually

A Junkers of the C-24 type is reported to have made a flight with a 600 hp engine burning a heavy oil instead of gasoline, an experiment on which Junkers has been at work for many years. The flight was said to have been successful.

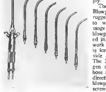
Czechoslovakia's state-controlled airlines last year flew 664,517 mi. and carried 6 231 passengers without a single fatal accident and with only two forced landings Direct connection with London is expected in the spring

Handley Page, Ltd, has signed an agreement with the Moth Aircraft Corp of New York city permitting the installation of automatic slots on the machines built by the American company

THE BUYER'S LOG BOOK

Oxweld Aircraft Blowpipe

TO MEET the demand for a blowpipe designed especially for aircraft fuselage welding, the Oxweld Acetylene Co, 30 East 42nd St, New York City, has added to its products the W-15 blowpipe This device is of the injector type and can be used on a low pressure acetylene supply



The Oxweld W-15 aircraft blowpipe and welding heads

The Type W-15 Blowpipe is of rugged construction to withstand any usage to which a blowpipe is subjected in this kind of work The handle is knurled to provide a good grip The 3/16 in oxygen and acetylene hose are connected directly to the blowpipe is of screwed hose connections being dispensed with Valves for adjustment of oxygen and acetylent pressure are placed on the handle in such a position that they can be operated by the thumb and forefinger of the hand holding the blowpipe, leaving the other hand free.

Seven welding heads are supplied with the blowpipe and are equipped with drawn copper tips to withstand high temperatures, curved to reach with ease the most inaccessible places encountered in aircraft welding Each welding head is detachable as a unit and each injector can also be detached from the welding head and replaced if necessary The welding head is connected to the body of the blowpipe with a double conical seat and is held in place with a knurled head nut This nut is designed to be tightened by hand, but is also provided with faces so that a wrench can be used for loosening it if necessary.

The various welding heads are all designed for a constant oxygen pressure of 20 lb. per sq in, making it possible for the welder to change the heads without changing the adjustment of the oxygen regulator

This blowpipe is extremely light, weighing slightly over 9 oz with the largest tip attached The center of gravity lies near the middle of the blowpipe so that correct balance is maintained when the hose is attached Thus continuous welding can be accomplished with a minimum of fatigue to the operator

Although primarily designed for aircraft use this blowpipe is also well adapted to work of all kinds on light tubing or sheet metal

A large number of blowpipes designed for special purposes is included in the products manufactured by the Oxweld Company The concern also manufactures many other welding and cutting devices and accessories, all of which is listed in its general catalogue which will be sent to persons interested on request

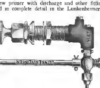
Primer-Shut Off Cock

A COMBINATION primer and shut-off cock for aircraft engine use has been developed by the Lunkenheimer Co, Cincinnati, O Its function is to provide a rich mixture which facilitates quick starting In cold weather, especially, it is valuable in feeding extra gasoline to the engine until it is warmed up and is running smoothly

A desirable feature of this new device is that both the primer pump and shut-off cock are mounted on the instrument board so that the shut-off cock is at all times under the observation of the pilot

The combined fitting is furnished as part of the standard equipment with the Wright J-6 series of "New Whirlwind" engines It has received the approval of both the Army and Navy. Pratt & Whitney Aircraft, Curtiss, Packard, Warner and many other manufacturers use Lunkenheimer Primers as standard equipment with their engines

The new primer with discharge and other fittings is illustrated in complete detail in the Lunkenheimer Aircraft Specialties Catalog No 2 This catalog also illustrates and lists a complete line of cocks, pipe and tubing fittings for aircraft, both Air Corps standard parts and commercial fittings Copies of the new catalog are available upon request.



The combination primer and shut off cock made by the Lunkenheim Company

Bohn Products

THE BOHN Aluminum & Brass Corp., Detroit, Mich, manufactures non-ferrous castings and completely finished bronze and steel back babbitt lined bearings for the aircraft industry.

The non-ferrous castings include crankcases, cylinder heads for air-cooled engines, pistons, oil pump bodies, supercharger housings, castings for control parts such as bellcranks, aileron, elevator, and rudder horns, Bohn special process bronze valve seat and valve stem guides.

All the products produced by the Bohn company are for original equipment and are not supplied for service or service replacement The company, however, furnishes bearings and castings to concerns who in turn supply them to consumers for service and service replacement The parts in each case that are supplied by Bohn are made to the drawings and specifications of the customer No so-called standard parts for any of the aircraft engines are carried

De Walt Junior Cutter

A NEW model of electric woodworker has been added to the line of the DeWalt Products Corp, Leola, Pa, and is known as the "De Walt Junior" This machine will handle accurately twenty-nine distinct cutting operations including dadoing, routing, mitering, shaping, grooving, ploughing, rabbeting, mortising, tenoning and gaining

The De Walt Junior incorporates the features of the De Walt "Wonder-Worker" with balanced, guided power applied to the saw in all cutting positions, instant change from cross-cutting to ripping without stopping the motor, provided with accurate ripping guage and dials for adjustment to any position The universal motor equipment has been carefully tested and engineering skill fully used in developing this universal motor of more horse power and greater motor efficiency The motor operates from either A. C or D C by plugging in the nearest light socket

The mere attachment of the necessary cutting tool, which is the work of a moment's time, adapts the De Walt Junior to another cutting job The work moves fast whatever the cutting operation, and all the work is handled from one side of the table, whether cross-cutting, ripping or shaping and layout marks are always in plain view

With 12-inch combination cross-cut and rip saw which is standard equipment, the DeWalt Junior rips 2-inch stock at the rate of 20 lineal ft per minute It is so speedy it routes one rise and tread stringer in 12 min Fitted on a wooden table 29x59 in the machine complete weighs 235 lb It is compact and readily portable and can easily be carried by two men to be set up on a pair of horses or moved about on a moveable truck Another special feature of the De Walt Junior is the roller bearing arm, making for easiness in operation not to be found in any other woodworker

Standard equipment includes adjustable guard that fits down to the work and gives positive protection to the operator.

Hycoe Brake Lining

THE MANHATTAN Rubber Manufacturing Co, Passaic, N J, manufacturers of Hycoe automotive products, has introduced a new feature in moulded brake linings, Hycoe moulded brake lining in rolls There is a great stock-reducing advantage in this new feature. This material is available in sizes ranging from ⅛-in by 1 in. to ⅜-in by 6 in

The high braking efficiency and long life of the lining is in no way affected by its flexibility which is of a sufficient

A roll of Hycoe moulded brake lining

degree to permit easy conformity with any arc shoe The same uniform co-efficient of friction and resistance to temperatures and moisture which characterizes Hycoe Hyperatures and moisture which characterizes Hycoe hydraulic compressed lining is retained in the new moulded

SIDE SLIPS

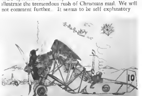
By Robert R Osborn

"MAIL FLYER, FORCED DOWN, RIDES HORSE"—Headline

Somehow this reminds us of the slogan being used by a New Orleans ice manufacturing company in its advertising campaign against the small home refrigerating systems The slogan is "A cake of ice never gets out of order"

* * *

The cartoon, which appears below, is the work of the radio operator for Varney Air Lines and was drawn to illustrate the tremendous rush of Christmas mail We will not comment further It seems to be self explanatory



* * *

H E H sends in an interesting clipping from a spark plug advertisement that appeared in a recent issue of *The Saturday Evening Post* It says:

"A beautiful silver seaplane is standing on a beach Its engines are quietly idling A young officer approaches in the uniform of a major With goggles adjusted he climbs into the plane, tests his engine and then signals to the ground men to remove the chuck blocks He speeds the engine and roars down the beach to sweep gracefully into the air . . . and there are wild cheers as the plane swiftly comes back and slides to a landing The flier climbs out and is embraced by his colleagues, for Major Mario de Bernardi has made the fastest time ever accomplished by man—318 69 miles per hour"

H E H comments on this most remarkable description as follows:

"Probably rotary floats, but there is no doubt in my mind that he slid to a landing, as the author states I guess our amphibians aren't so hot after all Well, anyway, in the conclusion it says that all of these great feats can be done by using the certain plug, but on that beach I'd rather have Barney Google's famous spark plug It's safer and might make a good four point landing"

* * *

WHAT, NO ELECTRIC STOVE?

"One of the exclusive features of the Patrician is a private sleeping compartment with a standard size berth, hot and cold running water and toilet facilities Although as yet no buffet has been installed, a refrigeration system is in operation"

This quotation is from a newspaper description of the new Keystone 'Patrician"

AGAIN LOCKHEED

Breaks the Record!

FLYING from west to east at a time when weather conditions are most adverse . . through driving rain, snow, sleet and blinding fog, weather that forced many planes to land and prevented others from taking off... lifting a gross load of three tons and at times reaching a ceiling of 15,000 feet, the Lockheed Air Express under the skillful control of Captain Frank Hawks, who with Oscar Grubb, mechanic, established a new transcontinental non-stop record, flying from Los Angeles to New York in 18 hours, 21 minutes and 59 seconds. This eclipses the former record made with Lockheed under favorable conditions, by 37 minutes!

The purpose of this flight was not to set a record! Its underlying objective was to prove to the American public that a pilot of ability and a sturdy, dependable plane form a combination that conquers all hazards encountered in flight It was to establish this fact that the flight was purposely made at a time when weather conditions were known to be most unfavorable

That the Air Express has so completely demonstrated its overshadowing dependability, stands as a glowing tribute to air mail pilots and operators who have so closely cooperated with Lockheed engineers in the development of this plane.

The Air Express is the result of more than two years' effort It is designed to carry mail and passengers at high speeds over great distances in *absolute safety* and utmost comfort. It represents the most modern development in single motored payload aircraft Complete information and specifications will be furnished operators on request.

Distributors
AIR ASSOCIATES, INC.
New York
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ERLE P HALLIBURTON
Duncan Oklahoma
HARRY SPERL AERO CORP
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Exclusive Representative,
Mexico and Central America

Lockheed Aircraft Company

LOS ANGELES CALIFORNIA

Whirlwind Vega Approved Type Certificate No. 43 — *Wasp Vega Approved Type Certificate No. 93* — *Wasp Air Express Approved Type Certificate No. 92*

More important than any tests...

Every step in the manufacture of Bethlehem Fine Alloy and Special Steels, from the mining of the ore to the last finishing operation, is carried out by Bethlehem—a condition most favorable to the maintenance of uniformly high quality.

EVEN though steel for use in airplanes and engines has passed the most critical inspections and tests, your confidence in it is greater if it is the product of a steel-maker with long experience and a reputation for high quality.

Bethlehem has complete modern facilities, extensive raw material resources, a department devoted entirely to the manufacture of fine steels, and a long and intensive experience in steel-making. Manufacturers in every line have used Bethlehem steels in their products for more than half a century.

Men in the aeronautical industry are finding Bethlehem a very satisfactory source of supply for steels to which they can entrust the safety and reputation of aircraft and engines with entire confidence.

BETHLEHEM STEEL COMPANY
General Offices Bethlehem, Pa.

District Offices New York, Boston, Philadelphia, Baltimore, Washington Atlanta Pittsburgh, Buffalo Cleveland, Detroit, Cincinnati, Chicago St. Louis, San Francisco Los Angeles, Seattle, Portland and Honolulu

Bethlehem Steel Export Corporation New York City, Sole Exporter of our Commercial Products

BETHLEHEM

Passenger Preference—too!

Every pilot who has flown a Challenger is quick with admiration and praise of Challenger's ease of control, immediate response, ability to land take off and climb steeply out of the smallest fields.

Now passengers too, at flying fields all over the country are voicing a preference to ride in Challenger planes. They, too, sense the sturdy construction, the absolutely safe flying features of Challenger. Challenger draws the paying rides!

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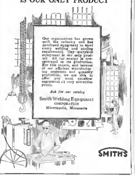

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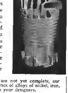

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WANTED. MODEL A or E used Hisso motor, not particular about condition of motor. Must be bargain. O. H. Kerr, 1235 East Tenth St., Okmulgee, Okla.

WANTED: ONE complete set Thomas Morse wings with fittings. Covering and woodwork must be good. Hans Mirow, 1053 No. Syracuse, Portland, Oregon.

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AVIATION

AERONAUTICAL ENGINEERING SECTION

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Feb. 16, 1929

Multi-Spar Wing Design *and* Analysis

By George W Debell, B.S. of M E., A.E.

BEFORE discussing the details of the design and analysis, the practical limits of application of multi-spar construction should be considered. This type of construction is primarily adapted to cantilever wings and unless otherwise stated this article will deal with this type of wing

On small airplanes, 2,500 lb. and under, multi-spar construction is unnecessary and cannot be applied economically. The chief reason for using this type of construction is to obtain torsional rigidity and so reduce the chances of flutter; but in small airplanes, properly designed two-spar construction furnishes all the rigidity necessary and at the same time is a much simpler type of construction.

Then too, even in two-spar construction minimum sizes are soon reached, and if multi spar construction were used the wing would be composed almost entirely of minimum sizes

This would give the latter type a poor strength-weight ratio The only time when multi-spar construction might be used to advantage on this size airplane is when the wings are tapered and metal covered, and it is quite probable even then that two-spar construction with ribs and metal cover would prove cheaper and more economical in the end

Above this weight limit two-spar fabric covered cantilever construction should be used with extreme care. Two-spar cantilever construction with plywood or metal cover may be carried considerably above this limit, but adequate tests should be made to determine the amount of stiffness derived from the cover.

In airplanes weighing in the neighborhood of 10,000 lb. either three-spar or multi-spar construction is applicable However, three-spar construction would seem more advantageous than multi-spar in this size airplane

Three-spar construction has the advantage of a smaller number of parts and at the same time does not require the excessive use of minimum sizes as would occur in multi-spar construction It is also sufficiently stiff to give all the torsional rigidity needed The detail requirements of the particular design under investigation would usually be the determining factor as to which type of construction to use

In large airplanes, around 20,000 lb and larger, multi-spar construction is almost a necessity since the structural members must be held down to reasonable sizes to facilitate purchasing, handling, and manufacture. It is hardly possible to use a simpler type of construction with strut or wire bracing because of the extremely large size of the struts and wires

In general, multi-spar construction is particularly adapted to tapered cantilever wings with metal covering The spars are so placed as to form the wing contour and the metal covering is attached directly to them. This obviates the necessity of ribs, except for metal bulkheads to hold the leading edge contour Multi-spar construction can be adapted to fabric covered wings by the use of ribs. However, these ribs consist merely of capstrips with perhaps one truss member near the leading edge and one near the trailing edge. In this case, as in the metal covered type, the spars really form the contour of the wing and the capstrips are attached directly to them In metal covered construction no drag truss is needed as the skin performs this function In fabric covered construction a drag truss must be used Steel construction of this type of wing may either be riveted or welded, while duralumnum construction may only be riveted However, welding does not lend itself readily to this type of construction since it is practically impossible to make welding allowances on so complicated a structure Even in a riveted structure care must be taken to prevent undue distortion in setting the rivets Although the first cost of a riveted structure would probably be somewhat greater than the primary cost of a welded structure, the riveted type would be cheaper in the long run since there would be less rejection cost and a great deal less assembly time The riveted type lends itself much better to interchangeability than the welded type

The methods of analysis of multi-spar wings are still experimental. The Germans (principally Professor Hugo Junkers) were the first to develop a successful multi-spar wing, but it is difficult to discover exactly what method of analysis was used in the design, as the data now obtained are quite meager and very incomplete. Also, due to the press of war, much of the design was accomplished by actual test work in the shops and therefore no design computations are available on the parts so fabricated Since the war, attempts have been made to derive methods of analysis which would check the actual design sizes of the wings built during the war They have been more or less successful, but have been so mathematically involved as to be practically useless in commercial design

For commercial use, the problem of multi-spar analysis is not to find an exact and involved expression for the loads in the members, but rather to find a fairly simple approximation which will give loads sufficiently accurate for actual design In 1922, the Engineering Division of the Air Service sand-tested a three-spar wing and from the actual deflections computed the loads carried by the spars Then they calculated the loads carried by the spars according to several different methods, or theories, and compared these results with those derived from the sand-test data and came to the conclusion that, from this one test, the Burgess Method gave the most satisfactory results They therefore recommended its use in the design

of multi-spar wings The results and conclusions of the above mentioned test are published in Air Service Information Circular, Number 394

In analyzing a multi-spar wing there are two methods which may be used In the first method, used by the Germans, no account is taken of the center of pressure movement, and the assumption is made that the metal skin takes all the drag forces and no beam forces In the case of the beam forces, the skin merely acts as a restraint member to hold the spars in their relative positions The second method, which is preferred in this country, takes account of center of pressure movement although the skin in metal covered construction is still assumed to take the drag forces In fabric covered construction a drag truss must be substituted to take the place of the skin In both methods of analysis the solution of the drag truss is identical, but the solution of the shear trusses and beams varies

The following is a description of the first method: For any section, calculate the position of the horizontal neutral axis and the moments of inertia of the spar tubes about this neutral axis (The true neutral axis will probably have a slight slope but assuming a horizontal line through the center of gravity will be sufficiently accurate for design purposes This assumption is also made by the Germans)

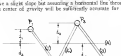


Fig 1—Typical multi-spar truss diagram

Then to find the design loads in the spars, proportion the moment which the spars carry, according to their moments of inertia In other words:

$$M = \frac{M_t}{I_t} \times I$$

Where M is the moment carried by any spar whose moment of inertia is I, M_t is the total moment on the section, and I_t is the total moment of inertia of the section or ΣI Then the load (P) in any spar $= P = \frac{M}{y}$ where y is the distance of the spar in question from the neutral axis But M is proportional to I, therefore

$$P = \frac{M}{y} = \frac{M_t}{I_t} \times \frac{I}{y}$$

or P is proportional to $\frac{I}{y}$ But in any beam, $\Sigma \frac{I}{y}$ about the neutral axis = O Therefore at any section $\Sigma P = O$

Then to find the exact distribution of shear in the trusses under the above loading the following method is used According to mechanics, in any beam subjected to a certain loading curve the shear and moment curves have a definite relation to each other; in other words, the moment produced by the shear trusses equals the moment taken by the chords or spar tubes Also at any section of a beam of the truss type the moment component (horizontal component) of the load in the compression chord equals the moment component of the load in the tension chord, and the moment at the section equals the moment component of the load in one of the chords multiplied by the truss depth at the section. In any wing the beam loads are vertical and the truss depths must be measured vertically in order to be in the same plane as the moment and shear Therefore, in a Junkers wing the distribution of shear among the trusses is proportional to the loads put in the spar tubes by the trusses multiplied by the vertical depths of the trusses In other words, the percent shear carried by any truss equals the moment carried by the truss divided by the total moment at the section For example: (Referring to Fig. 1.)

P_1 = load in spar 1
P_2 = load in spar 2
P_3 = load in spar 3
P_4 = load in spar 4

The percent shear in truss (1) =

$$\frac{M_1}{M_t} = \frac{P_1\ (d_1 + d_2)}{M_t}$$

M_t = the total moment at the section

But since P_1 is the load in one chord of the truss, the load exerted by the truss on the other chord must be P_1. Therefore the load put into spar 2 by truss (2) = $P_2 - P_1$, and the percent shear in truss (2) =

$$\frac{(P_2 - P_1)\ (d_2 + d_3)}{M_t}$$

Similarly, the percent shear in truss (3) =

$$\frac{[P_3 - (P_2 - P_1)]\ (d_3 + d_4)}{M_t}$$

Continue in this manner until the last truss is solved As a check let us assume that Fig. 1 represents a complete truss Then from the foregoing equations:

$$\Sigma P = 0$$

Therefore $P_2 + P_4 = P_1 + P_2$
or $P_4 = P_1 - P_2 + P_3$

and from truss (3) we have found that the truss exerts a force of $P_3 - (P_2 - P_1)$ on its chords Since P_4 is the chord of only truss (3) then

$$P_4 = P_3 - (P_2 - P_1) = P_3 - P_2 + P_1$$

and therefore the forces check

The total moment at the section $= M_t$
$= P_1 d_1 + P_2 d_2 + P_3 d_3 + P_4 d_4$
= the summation of spar moments

The summation of shear moments =
$P_1 (d_1 + d_2) + (P_2 - P_1)(d_2 + d_3) +$
$(P_3 - P_2 + P_1)(d_3 + d_4) =$
$P_1 (d_1 + d_2) + (P_2 - P_1)(d_2 + d_3) +$
$(P_3 - P_2 + P_1) d_3 + P_4 d_4 =$
$P_1 d_1 + P_1 d_2 + P_2 d_2 - P_1 d_2 - P_1 d_3 + P_2 d_3 +$
$P_3 d_3 + P_1 d_3 - P_2 d_3 + P_4 d_4 =$
$P_1 d_1 + P_2 d_2 + P_3 d_3 + P_4 d_4 = M_t$

and therefore the moments check and the summation of the percent shear will equal 100 per cent

The initial assumptions of considering the skin to take all the drag loads and no beam loads are reasonable and would produce very little error as the two assumptions would tend to neutralize each other, since actually the skin would not take all the drag but would take some beam load and so the total actual stress in the skin would be about equivalent to the initial assumption

The analysis of the drag truss in fabric covered construction is identical in both methods The details of the solution will not be given here but will be given in their proper place in the second method In metal covered construction the skin takes the place of the drag truss and some actual tests must be made to determine whether the skin is sufficiently strong to take these loads. (There is no method of analysis for determining the thickness of the skin except by actual test)

Before taking up the second method, it may be helpful to give here the Burgess Rational Method of distribution

as extracted from Air Service Information Circular No. 394.

The Burgess Rational Method

"The next solution of the problem to be considered is a rational, theoretical method, the development of which is due to Mr C P Burgess, of the Bureau of Aeronautics of the Navy Department, and with one or two minor changes in signs and nomenclature, is as follows

"Fig 6 shows the cross section of an internally braced multi-spar wing having n spars numbered from 1 to n, proceeding from the leading toward the trailing edge Curve A represents the distribution of the air force normal to the wing as a compound of the pressures on the upper and lower surfaces F is the resultant air force per unit length of the wing minus the weight of the wing

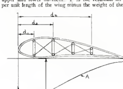


Fig 6—A cross section of an internally braced multi-spar wing having n spars numbered from 1 to n from leading to trailing edge Curve A represents the air force distribution normal to the wing as a compound of upper and lower surface pressures

per unit of length It is assumed that F acts at the center of pressure on the cross section The moment of F about the leading edge will be represented by M W_1, W_2, W_3 . . . W_n are the loads per unit length along spars 1, 2, . . n at the section under consideration I_1, I_2, . . I_n are the moments of inertia of the respective spars about their neutral axes, d_1, d_2, . . d_n being the distances of the spars from the leading edge If the wing root be assumed to be fixed in position the air load will cause the wing to bend so that any cross section will rise a vertical distance, v, and rotate through a small angle θ, the assumption being made that points in the cross section which lie on a straight line before, will lie on a straight line after the load is applied Figures 7 and 8* are drawn from the deflection data given in the foregoing tables and indicate that this assumption is reasonable.

"Similar plots have been made for the second panel point and the tip of the wing with results that agreed with those shown in Figures 7 and 8 The discrepancies from a straight line deflection as shown above are matters of one or two tenths of an inch, part of which may be accounted for by the precision of the deflection data It may therefore be said that the assumption that the wing is deflected and rotated by the air load without appreciable distortion is correct except, possibly, very near to the wing root.

"From the above assumption it may readily be seen that the vertical movement of any spar due to the rise and rotation of the cross section will equal $v + \theta d$ v the vertical deflection, being positive when upward, θ being considered positive for counterclockwise rotation about the leading edge

"The running load on the spar necessary to produce this deflection equals

$$w = kI\,(v + \theta d) \quad (1)$$

Multiplying the equation (1) by d we get

$$wd = kId\,(v + \theta d) \quad (2)$$

But wd = the moment of the load about the leading edge and for equilibrium it is necessary that

$$\Sigma w - F = 0 \quad (3)$$

and

$$\Sigma wd - M = 0 \quad (4)$$

By equations (1) and (3)

$$F/k = v\Sigma I + \theta\Sigma(Id) \quad (5)$$

By equations (2) and (4)

$$M/k = v\Sigma(Id) + \theta\Sigma(Id^2) \quad (6)$$

For convenience let

$$\Sigma I = a$$
$$\Sigma(d) = b$$
$$\Sigma(Id^2) = c$$

$$\left.\begin{array}{ll}\text{whence} & F/k = va + \theta b \\ \text{and} & M/k = vb + \theta c\end{array}\right\} \quad (7)$$

Solving these simultaneous equations we get

$$\theta = \frac{bF - aM}{k(b^2 - ac)} \text{ and } v = \frac{cF - bM}{k(ac - b^2)} = \frac{bM - cF}{k(b^2 - ac)}$$

Substituting these values in equation (1), gives

$$w = \frac{I}{b^2 - ac}\,(bM - cF + (bF - aM)d) \quad (8)$$

Equation (8) gives the running load per unit length on the spar at the section under consideration Once this loading is known, the shearing forces, bending moments, and fiber stresses may be calculated by the usual procedure for cantilever beams

"When designing a wing such as the Junkers, having the spars placed as shown in Fig 9, it will be necessary to provide 'ghost spars' represented by the dotted lines in the figure These imaginary members should be placed vertically above or below the actual members, the actual cross-section area being assumed as equally divided between the existing member and its ghost The computations are then carried on as in the ordinary case"

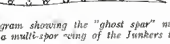


Fig 9—Diagram showing the "ghost spar" method of solving a multi-spar wing of the Junkers type.

End of Extract

In the second method, Mr Burgess' suggestion of the solution of a Junker wing by the "ghost spar" method is not used as it does not follow out his initial assumption that the wing deflects without distortion of the wing section. As he expresses it, "Points in the cross-section which lie on a straight line before, will lie on a straight line after the load is applied" His initial assumption presumes that any section is a rigid body and if this is true then the neutral axis must be a straight line. But the "ghost spar" method would give a cambered neutral axis which is obviously incorrect A more reasonable method, and the one which is used in the second method, is that the horizontal neutral axis be found and that the moments of inertia of the spar tubes about this neutral axis be calculated, using the actual cross-sectional area of the tubes Then the above moments of inertia are used in the Burgess formula and the computations carried on as in the ordinary case.

In the second method of analysis, as well as the first, the distribution of load among the spars must be computed for several sections along the wing and each spar should be designed for the average of the values of the various sections Usually, two approximations of tube sizes must be carried out before the resulting distribution checks the tube strength closely enough for design

Second Method of Analysis

For the first approximation all the tubes at any cross-section are assumed to be of the same size Then the contours of the root and tip sections are drawn and a reasonable tube size for each section is selected Having the tube size and the contour, the positions of the tube centers with reference to the datum line and leading edge are found Next, the horizontal neutral axis of the section as a whole is calculated and then the relative moments of inertia of the spar tubes about this neutral axis are found

To find the distribution of load, the Burgess Method is applied to the sections The foregoing moments of inertia are used in the Burgess Method instead of the "ghost spar" idea From the distribution at the root and tip sections a mean distribution for the spars is assumed, and the design moment and stress curves for the spars are drawn In getting the stress curve, the moment curve is divided by the spar depth (the distance from the horizontal neutral axis to the tube center)

To take account of the drag, the moment of inertia of the tubes about the vertical neutral axis is found and then the formula

$$f = \frac{My}{I}$$

is applied, where f = the drag stress in the tube, M = the drag moment, y = the distance of the tube in question from the neutral axis, and I = the total moment of inertia of the tubes about the neutral axis These loads can be calculated for the root section only and the loads at the other sections may be found by proportion If I is assumed to equal ΣAx^2 instead of $\Sigma(Ax^2 + I_0)$, the following simplification may be used:

$$f = S = \frac{My}{I} = \frac{My}{\Sigma Ax^2},\ P = \text{Load } Af = \frac{AMy}{\Sigma Ax^2}, \text{ but}$$

if the spar tubes are all of the same size,

$$P = \frac{AMy}{A\Sigma x^2} = \frac{My}{\Sigma x^2}$$

The total force in any spar is found by algebraically adding the beam stress to the drag stress The tube sizes for these forces are then picked, using a reasonable column length

The second approximation is carried out in the same manner, using the newer set of tube sizes.

The following is the method of analyzing the shear trusses In order to clarify the explanation of the method of analysis of the shear members, let us assume that we are dealing with a wing having nine spars numbered from 1 to 9, as in a Junkers wing Then there are eight trusses connecting the spars in the beam direction These trusses will be designated as follows 1-2, 2-3, 3-4, 4-5, 5-6, 6-7, 7-8, 8-9 It will be noticed that the truss designations consist of the numbers of the spar tubes which they connect The trusses connecting the spars in the drag direction will be considered later As they are all at very flat angles, their components in the direction of the beam shear will be neglected

The moment distribution from the Burgess Method is proportioned according to "I" (the moments of inertia about the neutral axis) and to "d" (the distance from the leading edge) It would be incorrect to assume the shear in the trusses to be proportioned to this distribution as the trusses are in no way connected with the neutral axis or with the spar tube moments about the neutral axis Therefore, the following method is used to calculate the percent shear in each of the trusses According to mechanics, in any beam subjected to a certain loading, the shear and moment curves bear a definite relation to each other Also at any section of a beam of the truss type the moment component (horizontal component) of the load in the compression chord equals the moment component of the load in the tension chord and the moment at the section equals the moment component of the load in one of the chords multiplied by the truss depth at the section In a wing of the Junkers type, the relative slope of the spar tubes in the beam direction is so slight that it may be neglected, as has been done in the Burgess Method, and the moment components of the loads can be assumed to equal the loads In any wing, the beam loads are vertical and the truss depths must be measured vertically in order to be in the same plane as the moment and shear Therefore, in a multi-spar wing the percent distribution of shear in a truss is equal to the load put in the spar tubes by the truss multiplied by the depth of the truss and divided by the total beam moment at the section, in other words, it is equal to the moment carried by the truss divided by the total beam moment at the section Due to the introduction of "d" into the moment distribution by the Burgess Method, the summation of the forces in the spar tubes at any section does not equal zero, and therefore the shear distribution by the above method does not sum to 100 per cent, but rather to a slightly greater value This will be explained later

In solving for the loads put in the spar tubes by any truss, it must be remembered that, with the exception of Spars 1 and 9, all the spars are the chords of two trusses and therefore each truss puts into a spar only part of the total load in the spar Since, as stated above, the summation of the forces in the spar tubes at any section does not equal zero, it is found that the loads remaining in the last two spar tubes, which must be taken by the last truss, are unequal This is naturally in error, as both loads should be equal (see first method), and therefore in order to neutralize this error it is necessary to solve for the spar tube forces due to the trusses by working first from front to rear and then from rear to front, and then in computing the percent of the total wing shear carried by the truss use the greater of the two spar tube forces found for the truss This method will give conservative percentages for the trusses, as is shown by the fact that the total of the percentages is greater than 100 For illustration of the method of finding the loads put in the spars by the trusses, let us assume that the loads in spars 1, 2, 3, 4, etc, are P_1, P_2, P_3, P_4, etc, respectively Then working from the front to the rear, spar 1 is a member of only truss 1-2 and the load put in the spars by this truss is P_1; then truss 2-3 puts $P_2 - P_1$ loads in the spars, truss 3-4 puts $P_3 - (P_2 - P_1)$ loads in the spars, and so on to truss 7-8 After truss 7-8 is solved it will be found that the load remaining in spar 8 is different from the load in spar 9, which is the error due to the summation of the spar tube forces not equaling zero Therefore, using the same method, work from rear to front so as to carry the error into truss 1-2 In working out the loads put in the spars by the trusses it will be found that due to the transfer of shear, the loads put in the spars by some of the trusses will be negative in sign In other words, in order to transfer the shear, these trusses *act in the direction of shear*

Then to get the per cent shear carried by a truss, select the greater of the two loads found for the truss

* Figures 7 and 8 are included in Air Service Information Circular No 394

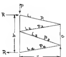
in working first from front to rear and then from rear to front, and multiply it by the truss depth and divide by the total beam moment. In the actual figuring of the per cent. shear in the trusses at any station, the following method may be used. At any station the distribution of beam moment is represented by the Burgess Distribution and the total beam moment of 100 per cent, that is by the total of the Burgess Distribution. Therefore if you represent the total beam moment by 100 per cent, which is the summation of the Burgess Distribution, you can represent the load in any spar by its Burgess Distribution divided by its distance from the neutral axis, in inches. Then using the foregoing representative loads, solve for the loads put in the spars by the trusses, working first from front to rear and then from rear to front. Next multiply the truss depth in inches by the greater of the two loads found for the truss by the method outlined in the preceding sentence, and the result will be the per cent. shear carried by the truss in question. This is true because the total beam moment is represented by the summation of the Burgess Distribution; in other words by 100 per cent.

Due to the center of pressure under the Burgess Distribution method not being concentric with the elastic centrum (in other words the center of rotation in torsion) there is a transmission of shear from front to rear, or vice versa, in such a manner as to require some of the trusses to act in the direction of shear instead of opposing it. However, in designing the trusses, no account need be taken of the direction of shear as all the members should be designed for compression whether the sign of the shear is positive or negative. In determining what condition of flight is critical for any particular truss, account should be taken of the load factors in the various conditions, since the critical condition must be determined by the maximum design shear.

If the following method of analysis is used in designing the drag trusses, only nose dive condition need be considered. In order to make the drag trusses sufficiently rigid to hold the spars in their relative locations they should be designed for a nose dive chord loading of two times the weight of the airplane proportioned as in low incidence, and in selecting the tube sizes all the loads should be asumed to be compression. It is readily seen that with this method of design high incidence and low incidence will not be critical.

The Army design requirements in nose dive condition were primarily worked up to apply to biplanes and are not efficient when applied to monoplanes. According to mechanics, in a rectangular box in torsion the maximum stress occurs in the large face, therefore the most efficient place to resist torsion is in this face. Now in a biplane, the two wings act as a single unit in torsion, and the large face in this case is the lift truss, but in a monoplane the lift truss is very shallow and the drag truss is the wide face. The Army ruling in nose dive calls for the weight of the airplane as the design drag load on the wings, and for monoplanes requires in addition an increase of 30 per cent. in the beam load. In a monoplane it would seem more efficient to increase the drag truss requirements rather than the beam truss requirements, as the drag truss is the wide face of a hollow torsional box and therefore is the most efficient place to resist torsional flexibility. The suggestion is therefore made that in designing monoplanes the nose dive drag requirements of the Government be considerably increased and the 30 per cent. beam requirement be omitted.

There is no precise or theoretically correct method of designing the drag truss of a multi-spar wing. In fabric covered construction a drag truss must be used, while in metal covered constuction the metal skin takes the place of the drag truss. The following is an arbitrary method of arriving at the sizes of the drag truss members. It is incorrect theoretically, but will give loads sufficiently safe for design purposes. The basis of this method is as follows:



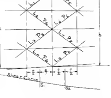
$$R = \frac{Pa}{b}$$

$$P_1 = \frac{R}{a} \times L_1 = \frac{Pa}{ba} \times L_1 = \frac{P}{b} \times L_1$$

$$P_2 = \frac{P}{b} \times L_2, \quad P_3 = \frac{P}{b} \times L_3,$$

$$P_4 = \frac{P}{b} \times L_4$$

The following is an illustration of the actual method of analysis used in designing the drag trusses.



Panel "e"

$$P_1 = \frac{S_1}{a} \times L_1 ; P_2 = \frac{S_1}{a} \times L_2 ; P_3 = \frac{S_1}{a} \times L_3 ; P_4 = \frac{S_2}{a} \times L_4$$

Panel "f"

$$P_5 = \frac{S_2}{b} \times L_5 ; P_6 = \frac{S_2}{b} \times L_6 ; P_7 = \frac{S_3}{b} \times L_7 ; P_8 = \frac{S_2}{b} \times L_8$$

Due to members "c" and "b" of the proof being missing in the actual drag truss and due to the fact that the drag moment can be taken out by the intermediate spars, the application of the above method to the design of the drag truss is approximate but conservative.

In either the first or second method considerable time may be saved and the analysis may be clarified and simplified by the extensive use of graphs and tables, for instance the solution of any particular beam may be done with the aid of a graph by plotting the moment, depth, and load curves against the spar length. The load curve being found by dividing the moment curve by the depth curve. Then the load at any particular point in the spar may be read directly, and, knowing the column length, the size of the member may be immediately selected. A similar graphical method may be used in solving the shear trusses. Most of the intermediate steps leading up to the graphs may be solved in tabular form. This system shortens the analysis and makes it concise and clear.

Technical Reviews

Society of Automotive Engineers, Paper on Chromium Plating Progress, by W. M. Phillips and M. F. Macauloy.—Since the successful plating of chromium on steel can be accomplished only after the part to be plated has first been properly plated with some other metal such as copper or nickel, the author presents a short summary of the advancement made during the last 10 years in the methods of plating with copper and nickel before discussing the development and advancement of chromium plating. Comparisons are made between the results obtained from manually operated plating tanks and semi-automatic and full automatic plating machines, and points out the improvements made as these processes were developed.

In the early stages of the development of chromium plating, satisfactory chromium plating solutions were obtained by dissolving chromium anhydride, CrO_3, in water to which was added a small amount of chromium sulphate, but the solutions were effective for a short time only, mainly on account of the presence of chromium sulphate. It was also found that the temperature and the current density used in plating were important factors, and that proper cleaning of the nickel surface was essential because if the solution was too strongly alkaline, the chromium either deposited with iridescent blotches or as a gray burnt deposit, or else peeled entirely. It was therefore necessary to do better polishing work on the base metal and better buffing work on the nickel surface.

Proper polishing is stated to be the secret of successful plating because the ultimate finish is no better than the finish given to the base metal. To eliminate the polishing cost would decrease the total finishing cost by about 75 per cent., according to the author. This is the aim of all manufacturers and they have met with success in some instances. One large company presses the part from highly polished steel, keeping the dies in such condition that no polishing is required after forming the piece.

In conclusion, the proper type of anode to be used in chromium plating solutions is discussed. Inspection methods to make certain that a part has been chromium plated completely are mentioned, and the uses of chromium plating to reduce wear are enumerated.

N. A. C. A. Technical Note No. 294. Wind Tunnel Forces in Wing Systems Through Large Angles of Attack, by Carl J. Wenzinger and Thomas A. Harris, Langley Memorial Aeronautical Laboratory.—The investigation was conducted at atmospheric pressure on both monoplane and biplane models over a range from minus 45 deg. to plus 90 deg. The tests were to determine effects of variations of tip shape, aspect ratio, flap setting, gap, decalage, sweep back, and airfoil profile. Effects produced by the variables are given in a preliminary form by a series of comparative curves, to be followed at a later date by a complete report on these tests.

A general survey of the curves illustrates the effects which change in the arrangement of the wing systems have on the lift and drag characteristic, especially at large angles of attack. For monoplanes, the most striking differences are due to changes in profile and in trailing edge flap angle, which produce large differences in maximum lift. The effect of stagger, in a biplane, on drag, is notable. The variations are concluded to be due to the shielding of the upper wing by the lower at large angles of attack.

National Advisory Committee for Aeronautics Technical Note No. 296. Bearing Strength of Wood Under Steel Aircraft Bolts and Washers and Other Factors Influencing Fitting Design. By G. W. Thayer, Forest Products Laboratory, Department of Agriculture.—During the past four years there have been a number of investigations on this subject both by the Army and the Navy. This report correlates, brings up to date and puts under a single cover all of the information essential to an understanding of the formulae. Bearing strengths, efficiency of hollow bolts, symmetrical loads parallel to the grain, end-loads, distance between bolts, and cross bolts are discussed in detail. Methods of cutting holes and reinforcing joints are also brought out.

National Advisory Committee for Aeronautics Technical Memorandum No. 486. Tank Tests of Twin Seaplane Floats by H. Herrman, G. Kempf, and H. Kloes from Luftahrtforschung, Jan. 3, 1928.—The report includes the results of an investigation of floats for a Udet "U 10 a" monoplane tested in the tank of the Hamburg Shipbuilding Laboratory on the effect of shape of the step, effect of distance between floats, effect of nose heavy and tail heavy moments, effect of shape of the bottom and maneuverability. It is concluded that a slight lengthening of the step to the rear greatly affects the water resistance. The distance between the floats should increase as the square root of the gross weight of the airplane with constant wing loading. The flat bottom float is said to be better for a wood bottom while a Vee bottom is better for metal.

National Advisory Committee for Aeronautics Technical Note No. 299. The Effect of Fillets Between Wings and Fuselage on the Drag and Propulsive Efficiency of an Airplane by Melvin N. Gough, Langley Memorial Aeronautical Laboratory.

The tests were made in the 20 ft. Propeller Research Wind Tunnel of the N. A. C. A. on a cabin type of high wing monoplane with stub wing. Tests were made with no fillets, with llets of six inch radius and 12 in. radius. It was found that at 100 m.p.h. the total drag, without fillets, was 279 lb. and that with six inch fillets this was reduced by two pounds and by the use of 12 in. fillets by 5.1 lb. The increase in propulsive efficiency due to the use of the 12 in. fillet was about one per cent. It is believed that though the reduction in drag and the increase in propulsive efficiency appear small; the use of fillets may become more important as an airplane design progresses.

Recent N.A.C.A. Cowling Developments

By FRED E WEICK
Aeronautical Engineer, Langley Field

SINCE the publication last November of the first tests with the N A C A low drag cowling for radial engines, there has been progress along various lines, and it is the purpose of this article to bring the developments as nearly as possible up to date It is worth noting at the outset that most of the leading airplane manufacturers have cowlings of the N A C A type under construction, and that there is a tendency for some to make rather radical changes in the original form of the cowling to facilitate its application to their particular airplanes It can not be too greatly emphasized that it required careful design and development, with many changes and tests, to obtain proper cooling with this cowling on the "Whirlwind" J-5 engine in the 20-foot wind tunnel, and that while a satisfactory form has been worked out for the J-5 engine both careful design and some development must be expected if the cowling is to be satisfactorily adapted to other engines Also, any change in the outside shape which destroys the smooth nose will, judging by tests made in the 20-foot tunnel, nullify to a large extent the gain in performance with the complete cowling

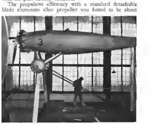
Wind Tunnel Tests

The cowling investigation in the 20-foot Propeller Research Tunnel at Langley Field has been completed The report on the first portion of the tests involving a cabin fuselage was published last November[1] The report on the second portion has just been published, including tests on (1) an open cockpit fuselage with the new complete cowling, conventional cowlings, and various types of individual cylinder cowlings, and (2) engine nacelles both with conventional cowlings and with N A C A complete cowling[2]

Most of the forms of cowling tested on the cabin fuselage have also been tested on the open cockpit fuselage, and, in addition, three forms have been tested on an engine nacelle, the "Whirlwind" J-5 engine being used in all cases The results show that with conventional cowling, the smaller the cross sectional area of the body behind the engine, the greater is the drag of the engine-body combination One of the nacelle tests was made with the bare engine alone (i e, without cowling or body) The drag of the engine alone was found to be 42 percent greater than that of the cabin fuselage with the uncowled engine on the nose The drag of the conventional nacelle was found to be 30 percent greater than that of the cabin fuselage-engine combination with the same form of cowling

With the new complete cowling, however, the drag of the nacelle is lower than that of the open cockpit fuselage, and the drag of the cabin fuselage is the highest The gain with the complete cowling is, therefore, much greater for nacelles and small fuselages than for large fuselages In fact, the saving in drag by the use of the complete cowling instead of conventional cowling was found to be more than twice as great with the nacelle as with the cabin fuselage The completely cowled nacelle had only about one fourth the drage of the conventional nacelle so that further improvement must necessarily be small compared with the gain already obtained.

The propulsive efficiency with a standard detachable blade aluminum alloy propeller was found to be about



One of the N A C A cowling tests in which fairing behind the individual cylinders were used

2 5 percent greater with the complete cowling than with any of the conventional cowlings, on the open cockpit fuselage

Tests were also made with separate fairings behind the individual cylinders and with complete individual hoods over the cylinders, as shown in the accompanying illustrations The fairings behind the cylinders were found to have no appreciable effect on the drag With the complete individual hoods only three cylinders were used for the drag tests because of insufficient room between the cylinders when all nine were in place The cooling tests were made with the complete engine, but with a hood on the

[1] "Drag and Cooling with Various Forms of Cowling for a 'Whirlwind' Engine in a Cabin Fuselage" by Fred E. Weick. N.A.C.A Technical Note No 301 November 1928 This note is now out of print, but will soon be re-published as "Drag and Cooling with Various Forms of Cowling for a 'Whirlwind' Radial Air-cooled Engine—I" N A C A Technical Report No 313

[2] "Drag and Cooling with Various forms of Cowling for a 'Whirlwind' Radial Air cooled Engine—II" by Fred E. Weick N A C.A Technical Report No 314

These reports may be obtained upon application to the National Advisory Committee for Aeronautics 18th and B Sts, Washington D C

A conventional engine nacelle being tested in the 20 ft Propeller Research Tunnel at Langley Field

The engine nacelle with N A C A cowling which was used in the comparative tests

top cylinder only This cylinder did not cool properly except with very large openings in the front and rear of the hood, and with the large openings the drag was greater than with the hoods removed The individual hoods and fairings, therefore, do not show much promise for the type of cylinder used on the J 5 engine

Agreement Between Flight and Wind Tunnel Tests

Many doubted the accuracy of the first flight tests with the new cowling, in which the maximum sea level speed of an Army AT-5A airplane ("Whirlwind J-5 engine) was increased from 118 m p h with the original cowling to 137 m.p h, with the N A C A cowling, an increase of 19 m p h The full throttle revolutions were 1,900 in each case, so that the engine power was as nearly as possible the same The increase of 19 m p h seems, offhand, very remarkable, but the AT-5A airplane fuselage has a cross-sectional area of only 7 sq ft, so that a large gain is natural as shown by the full scale wind tunnel tests, and there are also other factors which help to increase the speed The propulsive efficiency with the complete cowling at 137 m p h is more than 5 percent higher than that with the original cowling and exposed engine at 118 m.p.h,, as found from full scale tests in the 20 ft tunnel on the identical propeller used in the flight tests About half of this increase in efficiency is due to the higher pitch setting of the propeller at the higher speed and about half to the smoother body behind the propeller with the complete cowling Also, a lower angle of attack is required at the higher speed so that the drag coefficient is less The difference in drag is due almost entirely to the fact that the induced drag is less at the higher speed

When these secondary factors are considered, calculations show that the reduction in drag indicated by the flight tests agrees exactly with that indicated by the wind tunnel tests for the same size body

It is interesting to compute the power required if the speed of the original AT-5A airplane were increased from 118 m.p h to 137 m.p.h by the use of a more powerful and, therefore, larger engine In that case, the drag would be increased, not only because of the larger engine, but also because with the same size fuselage the ratio of fuselage to engine size would be smaller Also, the larger engine would be heavier, resulting in a higher induced drag than with the original weight Calculations of this nature have been based on the following assumptions

(1) The total increase in engine and structure weight due to increased size of engine is at the rate of 3 lb. per h.p
(2) The frontal area, and consequently the drag, of the engine vary as the square root of the power (This is an approximate empirical value obtained from the Scarab, Whirlwind J-5, Wasp, and Hornet engines) (This is correct within 1 percent)
(3) (Propulsive efficiency is the same for both cases,

With these assumptions, calculations show that it would require approximately a 350 h.p engine, similar to but, of course, larger than the J-5, to obtain the same high speed and cruising speed as was obtained with the 200 hp J-5 equipped with N A C A complete cowling

The fuel consumption at the same high speed or cruis-

Front view of a Berliner monoplane equipped with the N A C A low drag cowling

ing speed would, of course, be about 75 percent greater with an uncowled 350 hp. engine than with a completely cowled 200 hp. engine. The take-off and climb, however, would be better with the 350 hp. uncowled engine, although the climb with the completely cowled 200 hp. J-5 is somewhat better than with the same engine uncowled. The example of the AT-5A probably represents the maximum gain that is likely to be obtained with any type of airplane. It is a good example, also, for emphasizing the advantages of obtaining improved performance through better aerodynamic form rather than merely installing larger and more powerful engines.

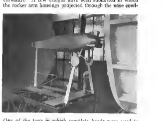
Further N. A. C. A. Flight Tests

The National Advisory Committee for Aeronautics has undertaken the project for the Army and Navy of fitting two airplanes with the new complete cowling and making complete performance tests with both the original and the new forms of cowling. The Army is furnishing a Fokker transport with three Whirlwind J-5 engines and since the cowling for the J-5 has already been developed, no difficulty is anticipated with this airplane. The tests should bring out the high gain due to the complete cowling on the two nacelles. According to the wind tunnel tests, this gain should be so great that the airplane should attain its present maximum speed with the two wing engines alone, if the nacelles were equipped with complete cowling and the nose engine removed entirely.

The Navy has furnished a Curtiss pursuit plane with a 425 hp. Wasp engine. The complete cowling for the Wasp engine may take considerable development before it is satisfactory.

A view of the Berliner monoplane with one section of the cowling removed showing interior construction. Note exhaust ring and deflectors

Most of the leading aircraft manufacturers have cowlings of the N. A. C. A. type under construction, and several have submitted their designs to us for comments. There is a natural tendency on the part of some to make pronounced changes in the form of the cowling in order to apply it to their particular types of airplanes with as few changes as possible. The best results can not be expected unless the cowling fairs well with the fuselage lines and unless the nose is smooth at the region of sharp curvature. A few designs have been submitted in which the rocker arm housings projected through the nose cowling, and from the results of the tests in the 20 ft. wind tunnel, it seems likely that at least half of the gain due to the complete cowling would be lost in these cases.



One of the tests in which complete hoods were used to enclose the individual cylinders. The same J-5 engine as used with six cylinders removed

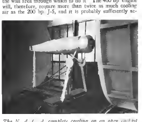
Probably the main reason for allowing the rocker arm housings to project is that the planes have been designed to make use of the range of vision between the cylinders. This is particularly true in the case of cabin planes with nose engines, in which the pilot is located immediately behind the engine. In most of these cases, proper range of vision can be obtained with complete cowling by mounting the engine slightly lower in the fuselage. If this is not practicable because of insufficient propeller clearance, either the landing gear can be made slightly higher or the pilot can be placed a little higher in the fuselage. The latter method might require that the fuselage be made deeper, but considering the gain due to the cowling, this would be well worth while.

Application of Complete Cowling to Other Engines

The complete cowling has been developed in the N. A. C. A. tests to the point where it is satisfactory for the J-5 engine. This development required considerable effort, and while much was learned about the general application of the cowling to all radial air-cooled engines, a certain amount of further development must be expected for each design of engine to which it is applied.

It is necessary, in applying the N. A. C. A. cowling to a new engine, to determine the size of the nose and slot openings for the passage of the cooling air. The amount of cooling air required depends not only on the power of the engine, but also upon the size and construction of the cylinders. A large cylinder is harder to cool than a small one because it has less wall area in proportion to its volume.

Suppose it is desired to design an N. A. C. A. type complete cowling for a 400 hp., nine cylinder radial air-cooled engine, having a cylinder construction similar to that of the 200 hp. nine cylinder J-5. If both engines develop the same mean effective pressure and run at the same revolutions, a cylinder of the 400 hp. engine has twice the volumetric displacement of a J-5 cylinder. The wall area of the larger cylinder, however, is only $(2)^{2/3}$ or 1.59 times as great as that of the J-5 cylinder. Since the 400 hp. engine has twice the power of the J-5, it has twice the amount of heat to dissipate, but only 1.59 times the wall area through which to do it. The 400 hp. engine will, therefore, require more than twice as much cooling air as the 200 hp. J-5, and it is probably sufficiently accurate as a first rough approximation, to increase the size of the cooling air passages over those for the J-5 by the factor 2 and also by the factor 2/1.59. They would then be 2×2/1.59=2.52 times as great as those of the J-5 cowling.



The N. A. C. A. complete cowling on an open cockpit fuselage with Whirlwind J-5 engine

The above method can be expressed by means of a formula as follows

$$R = \frac{hp}{200}\left(\frac{hp}{200} \times \frac{9}{N}\right)^{1/3}$$

where R=ratio of cross-sectional areas of air passages with new engine to those with the 200 hp. J-5.
hp.=horsepower of new engine
N=number of cylinders on new engine

This will probably give fair dimensions for a start from which the development of the new cowling for any particular engine can proceed. Allowances should also be made, of course, if the cylinders are constructed in a different manner or of a different material from those of the J-5.

New Cowling on Berliner Monoplane

The Berliner monoplane with a 110 h.p. Warner "Scarab" engine is, to the writer's knowledge, the first commercial airplane to be fitted with the N. A. C. A. complete cowling. This airplane was first flown about the middle of January and has been in the air a total of about two hours since, although no performance tests have been made at the time of writing. The cooling of the engine has been quite satisfactory in these flights, but no severe cooling test has been possible because of the cold weather.

The ideas regarding construction suggested in the first article on the N. A. C. A. cowling, which appeared in Aviation, November 4* have been carried out in the cowling on the Berliner monoplane, and the results are apparently very satisfactory. An exhaust ring is incorporated in the nose of the outer cowling as shown in one of the accompanying views. The outer portion of the nose cowling is made up of three quickly detachable sections which are mounted on the exhaust ring in front and on longitudinal braces along the sides. The two bottom longitudinals are formed by discharge exhaust stacks leading back from the ring. When the three sections of outer cowling are removed the engine is as accessible as with a small amount of conventional cowling.

New Cowling on Wasp Powered Lockheed

The news has just been received that a Lockheed monoplane equipped with N. A. C. A. cowling has set a new record for the non-stop flight from Los Angeles to New York. This is the most severe test the new type cowling has had to date. All of the reliable information regarding it on hand at the present time has been obtained from the following telegram from the Lockheed Company:

"ATTENTION LIEUTENANT TOM CARROLL: LOCKHEED AIR EXPRESS PILOT FRANK HAWKS WHICH JUST ESTABLISHED NEW LOS ANGELES TO NEW YORK NON-STOP RECORD OF EIGHTEEN HOURS TWENTY-ONE MINUTES IS EQUIPPED DITH N A C A COWLING WHICH INCREASED ITS SPEED TWENTY MILES PER HOUR FROM 157 TO 177 STOP COOLING CAREFULLY CHECKED AND OK STOP RECORD IMPOSSIBLE WITHOUT NEW COWLING ALL CREDIT DUE N A C A FOR PAINSTAKING AND ACCURATE RESEARCH AND GENEROUS POLICY STOP KINDEST PERSONAL REGARDS STOP LETTER WITH DATA AND PHOTOS FOLLOWS:

JERRY VULTEE,
LOCKHEED AIRCRAFT CO."

*"The New N. A. C. A. Low Drag Cowling," by Fred E. Weick. Aviation, November 17, 1928.

TECHNICAL PUBLICATIONS RECEIVED

N. A. C. A. Technical Memorandum No. 477. Contribution to the Design and Calculation of Fuel Cams and Fuel Valves for Diesel Engines by Jatindra Nath Basu from Der Motorwagen, May 10 and July 31, 1927.

N. A. C. A. Aircraft Circular No. 82. Description of the Armstrong Whitworth "Starling" (British single seater fighter).

N. A. C. A. Aircraft Circular No. 78. Description of the Savoia Marchetti "S 64" Airplane.

Army Air Corps Information Circular No. 615. Study of Horizontal Tail Surfaces of Consolidated XPT-3 (NY-1). By Theo de Port.

Bureau of Aeronautics, Navy Department, Technical Note No. 188. Emergency Flotation Gear—Protection of Bottles from Excessive Temperature.

National Advisory Committee for Aeronautic Report No. 308. Aircraft Accidents, Method of Analysis. Prepared by Special Committee on the Nomenclature, Subdivision and Classification of Aircraft Accidents. George K. Burgess, chairman.

National Advisory Committee for Aeronautics, Technical Memorandum No. 485. Research on the Control of Airplanes by B. Melvill Jones from a lecture before the Royal Institution and printed in "Nature."

National Advisory Committee for Aeronautics Report No. 300. The Twenty-Foot Propeller Research Tunnel of the National Advisory Committee for Aeronautics by Fred E. Weick and Donald H. Wood.

National Advisory Committee for Aeronautics Aircraft Circular No. 84. Description of the Caproni "Ca 97".

Aileron Arrangement

A Report of the Conclusions Reached After a Series of Tests on Rolling Moments on Models of Complete Airplanes

By SHATSWELL OBER
Massachusetts Institute of Technology

THE problem of lateral control, in particular at low speeds of flight, is of greatest importance, and therefore has been the object of much experimentation, argument, and discussion. A small phase of the problem, the effect of aileron arrangement on the magnitude of the rolling moment available to maintain the wings horizontal in "bumpy" air will be considered in this note.

"Arrangements of ailerons" will be used to mean the distribution of aileron area between the two wings of a biplane, rather than the shape, type or character of the individual aileron. The question arises whether it is better to put the entire aileron area in the upper wing, (a not uncommon practice), divide it between the wings or put ailerons on the lower wing only. This note is an analysis of the results of a long series of tests of rolling moments on models of complete airplanes made at the Massachusetts Institute of Technology. Results of similar tests on monoplanes will be considered for comparison

Lest the problem should become too involved, the simplest possible basis for comparison is used, which is the ratio of aileron area to wing area. As the coefficient used involves the span, and the ratio of distance between aileron C. P.'s and span does not vary too much, no factor to allow for this ratio is included. Some form of coefficient is necessary to compare results of different size lar tests on monoplanes will be considered for comparison

$$K_L = \frac{\text{rolling moment}}{bSV^2}$$

V = air speed in m p h
S = wing area in sq ft
b = maximum span of wings, ft

The rolling moments due to ailerons at small control angles are directly proportional to the angle, so comparison of arrangements can be made at one aileron setting, provided it is not too great. Twenty degrees has been selected, with no differential action, i.e. ailerons on one side 20 deg. up, on the other 20 deg down from the neutral position in line with the trailing edge of the fixed portion of the wing. The question of the influence of differential action will be considered briefly later.

If we consider the variation of rolling moment with angle of attack, it is found that tests on all models have a certain similarity. The roll is approximately constant from angles near zero lift to some 4 deg. below the angle of maximum lift, often there is some increase at some angles between these, then the roll decreases as the stalling angle is approached and passed. The manner and abruptness of this decrease is most affected by the aileron arrangement.

Turning first to the part of the curves similar for all models, in Fig 1 are plotted mean curves of K_L, the rolling moment coefficient, against the percentage ratio of aileron area to wing area for high speed assumed as twice V minimum. Tests on individual models may show considerable variation from the mean but except for a few scattered points the curves are well established. There is no consistent difference in the roll given by different aileron arrangements on biplanes. Monoplanes show definitely a slightly greater roll for a given per cent of aileron area.

Mean curves of K_L at maximum lift (minimum speed) against per cent aileron area are plotted in Fig. 2. Owing to the variations in form of lift curves near maximum lift points from individual models show more variation than at high speed (¼ max. lift), but there is a distinct division into groups as shown. Biplanes with ailerons on both wings and the few examples with ailerons on lower wing only have a much slower reduction in K_L as minimum speed is approached. Monoplanes give rolling moments lower than those for biplanes with ailerons on upper wing only. Classed together with biplanes of equal or nearly equal wings and ailerons on upper wings only are the biplanes with lower wing much smaller which approach monoplanes. Of these two divisions that with equal wings has in general the lower roll.

Fig 3 merely indicates the lowest value reached by the rolling moment coefficient at any angle of attack less than

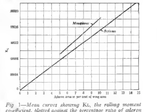


Fig 1—Mean curves showing K_L, the rolling moment co-efficient, plotted against the percentage ratio of aileron area to wing area for high speed = 2V (min)

28 deg. Most models give a distinct minimum value a few degrees beyond maximum lift. It must be remembered that the roll indicated is that in steady flight, not that if the plane were spinning with a mean angle less than 28 deg. The variation of individual models is less than at maximum lift and no distinction between arrangements on biplanes or between biplane and monoplane is possible. The variation due to arrangement is therefore more in the manner in which the roll is reduced than its ultimate minimum.

An examination of values of the ratio of aileron area to wing area shows a range for biplanes of from 6 per

cent. to 15 per cent with an average of about 9 per cent., and a range for monoplanes of from 6 per cent to 10 per cent with 8 per cent. the mean. Several of the biplanes on which the lateral control in flight is known to be good, have ratios higher than the 9 per cent average.

To give a better idea of the variation of roll with angle of attack, Fig 4 has been drawn for the three biplane arrangements and for monoplanes. Average aileron area ratios of 9 per cent for the biplanes and 8 per cent. for the monoplanes have been assumed. For convenience the high speed has been fixed at 0 deg angle of attack. Then the typical monoplane will have maximum lift at perhaps 16 deg. while the biplanes not until 18 deg. While as indicated by Fig 3, the least roll in any case is about the same it occurs successively later after maximum lift for monoplanes, biplanes with ailerons on upper wing only, biplanes with ailerons on both wings, and biplanes with ailerons on both wings, and biplanes with ailerons on the lower wing only.

Perhaps some physical conception of the magnitude of rolling moments may be had by calculating the position of the resultant force (lift) to give the roll. Consider

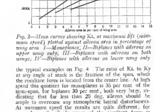


Fig. 2—Mean curves showing K_L, at maximum lift (minimum speed) plotted against aileron area in percentage of wing area. I—Monoplanes, II—Biplanes with ailerons on upper wing only, III—Biplanes with ailerons on both wings, IV—Biplanes with ailerons on lower wing only

the typical examples on Fig 4. The ratio of K_L to K_y at any angle of atack is the fraction of the span, which the resultant force is located from the center line. At high speed this quotient for monoplanes is 36 per cent of the semi-span, for biplanes 30 per cent., both very large, indicating that far less than 20 deg. aileron should be ample to overcome any atmospheric lateral disturbances. At minimum speed the results are quite different, for monoplanes the displacement of the resultant force is only 3.6 per cent of the semi-span, biplanes with ailerons on the upper wing only, 4.6 per cent., biplanes with ailerons either on both wings or on the lower wing only, 6.4 per cent. It is readily conceivable that any of these at V minimum may be exceeded by differences in lift due to bumps, etc. The reduction is due not only to less effectiveness in roll but, being an aerodynamic effect, the roll varies as the square of the flying speed. Roughly at least the absolute effect of bumps would be independent of the air speed, so the critical region is at low speed.

On biplanes the arrangement of ailerons on the upper wing only gives distinctly less roll in the critical region than either two ailerons on the lower wing or four on both wings. This arrangement should therefore be avoided, particularly when the wings are equal. Even when the lower wing is of somewhat smaller span and chord there should be ailerons on the lower wing as well as the upper. When the lower wing is very small, i.e. when the biplane may be called a sesquiplane, the upper wing approaches monoplane characteristics and ailerons on the tiny lower wing should be of little value.

This note has assumed that right and left ailerons move through equal angles. The experimental work also gives the effect of differential action. Of course the real reason for differential action is to reduce the yawing moment caused by the ailerons. At high speed the effects of turning ailerons up or down are nearly equal, so only the critical low speed region will be discussed.

With ailerons on both wings the roll due to the up ailerons exceeds that due to the down, by a mean of

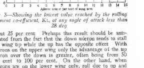


Fig 3—Showing the lowest value reached by the rolling moment co-efficient, K_L, at any angle of attack less than 28 deg

about 25 per cent. Perhaps this result should be anticipated from the fact that the down aileron tends to stall the wing tip while the up has the opposite effect. With ailerons on the upper wing only the advantage of the up aileron over the down is greater, often being from 50 per cent to 100 per cent. On the other hand, when ailerons are on the lower wing only, roll due to up and down ailerons is nearly equal. On monoplanes the up ailerons give slightly more roll.

When the roll due to the up ailerons is much greater, a distinct improvement in rolling moment available can be made by a differential gear allowing a greater movement of the up ailerons than the down. This would be of benefit in particular when the ailerons are on the upper wing only. There is a distinct advantage in turning the aileron away from the gap between the wings. With ailerons on upper wing, this and the natural advantage of up ailerons add, with ailerons on lower wing the effects nearly balance. Therefore in the latter case differential action is detrimental to roll (it may be justified by advantage in yaw).

The reason for the deficiency on roll when ailerons are on the upper wing only is apparent from consideration of air flow. With ordinary wing arrangements, the upper wing of a biplane "burbles" first, the lower much after

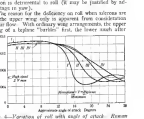


Fig 4—Variation of roll with angle of attack. Roman numeral references are the same as those of Fig 2

the cellule has reached its maximum lift. So at maximum lift of the cellule, if ailerons are on upper wing only, they are operating on a burbled airfoil. Conversely, if the ailerons are on lower wing only, they pperate on an airfoil well below the stall, so in theory this arrangement should be better, but experiment shows no improvement over the arrangement with ailerons on both wings.

The Design of Aircraft for Catapult Use

By LIEUT. LLOYD HARRISON
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THE limited application of catapulting in modern aircraft operations renders it an analysis condition not generally required, and hence familiar only to the comparatively few designers who have been concerned in building certain shipboard operating Naval planes. The condition is by no means a difficult one, however, for the designer, but principally requires a special care in detail design. It is not possible or useful to go completely into detail as to the construction or operation, for these may differ extremely between types; certain general considerations may, however, be of interest, particularly to those who may be considering Naval business, or construction of planes for ship and shore service, or for service to airports moored at sea or near congested centers.

Historically, launching devices have had a very real part in the contest to be first to fly. It will be recalled that the epochal flights of the Wrights at Kitty Hawk were made from a monorail track, the sloping of which was sometimes employed to assist in securing take-off speed, and that these pioneers later used a falling weight device to assist in take-off. Langley catapulted his model from a houseboat in the Potomac, and discussion regrettably still continues as to how determinative catapulting failures were in his lack of final success with man-carrying aircraft. Present day catapulting is practically limited to seaplanes (of either float or hull type) and to amphibian aircraft. The launching of present day landplanes does not appear to offer serious difficulties, but it is unnecessary on land, and its use at sea is limited by the natural preference for seaplanes in flights over water.

Catapult Installations Complete

Due to the light weight of early planes, the lack of any rigorous space limitations and the single function of the catapulting device, the early catapult could be a relatively simple machine. Modern shipboard planes are compact concentrations of weight and power; the battleships and cruisers from which they operate are extremely limited in deck room, and the catapult has to serve other purposes than the launching proper, such as turning up platform, routine plane stowage (even during storms); and the device must be operated repeatedly, with only a moderate time interval. It results that the typical modern catapult installation is far from simple.

The typical modern catapult consists of a track and supporting structure (which also supports the engine) usually rotatable; an engine, usually a compressed air or power gun; a car moving on the track, operated by a cable moved by the engine, and devices to hold the car in a fixed position when not operating or when the plane engine is turning up. It also includes devices to arrest the motion of the car at the end of the run so that it may be recovered undamaged, returned to starting position and used again, and of devices on the plane or car for holding the plane to the car properly under the several operating conditions, and for releasing it at the proper time. Further special devices are required which, while not properly a part of the design against the actual catapulting, are required properly to take care of the transfer of the plane from the water to the ship, and are not found on planes not used for shipboard operation; these impose local loads that must be designed for. Such devices depend on the operating doctrine, and hence must be particularly specified by the user.

Design of Catapult and Car

The structural design of the catapult and its car, while not at present a province of aircraft designers not in Governmental organizations, deserves at least passing mention because of the fact that, in the interests of weight saving, this design is conducted by the methods of the aeronautical engineer, and because the car must be designed for actual decelerations very many times gravity. A catapult car is an obvious practical example of the fact that it is sometimes not of the slightest use whatever to attempt to make an assembly stronger by making every part of a larger size in the same material.

Matters pertinent to the design of the aircraft proper against the catapulting loads are the primary interest of aeronautical structural engineers. Aircraft structural design problems have, of course, several stages. The first is the specification of the conditions of design and of the external forces and their magnitude and direction, usually the responsibility of a Government engineer. This for catapulting is unusually determinate. The second is the choice of a type of construction and is not usually determined by the catapulting condition. The third is the stress analysis of the actual primary structure to enable or justify choice of member sizes. A fourth, the checking of parts other than the primary structure for special loads imposed, is a matter which experience indicates it is most difficult perfectly to accomplish for the catapulting condition on a first plane.

The specification of design loads for the catapult condition is an unusually simple problem, for the normal loads are completely determinate in direction and reasonably determined in magnitude. The catapulting load acts parallel to the track, and the plane's weight and engine thrust are fully known. For the Navy catapults the actual accelerations have been ascertained by instruments and the results are stated in the detail specifications for

the aircraft, dependent upon which of the standard catapults is to be used. For other catapults and special uses, it is adequate to calculate the average acceleration required to attain take-off speed in the length of run available as determined by the length of the catapult track, increasing this average value by a certain percentage (supplied by the designer of the catapult) to allow for a normal peak load.

In order to take care of malfunctioning and of side wind or rolling loads during launching, it is customary to use a factor of safety, based on ultimate strength, of not less than three for the catapult thrust and hold down loads, instead of approximately two, as is elsewhere usual in the aircraft practice. This factor should take care of those shipboard conditions during which catapult operations are permissible, but cannot normally take care of storm conditions, for which special stowage and fastening arrangements are required.

There result three important conditions for design, for which the aircraft structure must be checked.

A—The airplane fast on the car, engine turning up full power, before catapulting. The loads acting are the plane's weight (factor of safety of two), the fullstatic thrust of the propeller (factor of safety of three), the reactions at the car, and the pull of the attachments holding back against the thrust.

B—The airplane in its first few feet of travel after the catapult thrust has been applied. The loads acting are the plane's weight (factor of safety of two), the static thrust of the propeller (factor of safety of two), the towing load (catapult thrust, factor of safety of three) the reactions of the car and the pull of the attachments holding the plane from capsizing backwards, and, internally, the weight and inertia loads in the plane.

C—The airplane in its last few feet of travel on the catapult. The loads acting are the difference between lift and weight (taken as negligible), the dynamic thrust of the propeller (factor of safety of two), the towing load (catapult thrust, factor of safety of three), the reactions of the car and the pull of the attachments holding the plane from capsizing backwards, and, internally, the weight and inertia loads in the plane.

Consideration of the above conditions will show that the structural members for which the catapulting condition is most likely to give design stresses are the landing gear struts and wires (unless catapulting is from a point on the fuselage instead of the landing gear), the complete side trusses of the fuselage structure at the forward end, and the members providing a carry through to these trusses of the principal items of the useful loads. So far as the general design of the airplane is concerned, it is obvious that a truss type of structure at the forward end of the fuselage has special advantages over the monocoque where catapulting is required, since it is adapted to carrying concentrated loads in any direction, whereas the natural direction of the distributing structures for concentrated loads in monocoque construction (that is, the bulkheads) is a transverse one, at right angles to the direction of catapult thrust.

Familiar Engineering Methods Used

The actual stress analysis for the calculation of the loads in principal members is simple, compared to many airplane analysis problems, once a clear understanding of the nature of the towing and attaching devices on the particular catapult be gained. These devices differ very much for the different types, and cannot here be described in detail. It is sufficient that the designer know where and how attachment is made to the plane for support and hold back in condition (A), and for support (saddle), hold down and towing in conditions (B) and (C). These matters being known, the calculation of loads is started at the points of contact with the car, and the loads are followed through the fuselage structure, considering, for calculating loads, that the fuselage is pin jointed with loads and structural weights concentrated at panel points. In case important items of weight are situated on the wing (such as wing engines, floats and bombs) it becomes necessary to check the drag trussing in the wings. The analysis proper can be done by the most familiar structural engineering methods for solution of trusses, and hence need not be elaborated upon. A graphical method is usually employed. A sketch of the fuselage skeleton of a single float seaplane, catapulted from the keel line of the float, is given herewith. The members which are subjected to their heaviest loadings in the catapult condition are heavily drawn in Fig 1.

The third step in the stress analysis work, choice of member sizes, needs no special remark except that it is more important that members critically stressed in catapulting make good completely the strengths required than it is for most other conditions of design since it is not practicable to approach the critical load in operation by gradual stages as is the case with stunting; the extreme load is, to a certain approximation, approached at every catapult shot including the first. The load is, moreover,

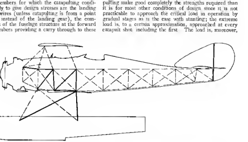

Fig 1—A diagram showing a conventional float type sea plane structure indicating members designed for a catapulting load

continued for a very definite time, and the pilot is powerless to modify it if he feels warning of a failure The consequences of failure are uniquely liable to be fatal since a definite run must be successfully completed and no altitude is available thereafter for such an escape as parachute jumping from air difficulties

Experience indicates that the difficulties actually to be expected are not with primary strength members, which seem generally to be carefully checked. The difficulties at test catapulting generally are concerned with fits, loads and clearances The difficulties that show up in service operations are tremendously varied Engine cowling and air scoops loosen, power plant controls are jarred out of their settings, gasoline tank, baffle and fitting connections crack and give rise to leaks, oil tanks get free from their supports, radiator supports fracture, seat backs buckle, ordnance attachments develop play, shear pins in the car attaching cables bend, rivet heads on the bottom tear up the saddle facing, or progressive failures of attachment assemblies of border line strength occur Many difficulties could be forecasted by inspection of an uncovered, fully assembled airplane on the final assembly floor with special attention to the fore and aft support of installation details.

In summary, it may be stated that catapulting need seldom be considered in design, except for certain Naval types and other special marine uses Provision for it in the primary structure occasions little special difficulty but implies added weight (of the order of 1 per cent) Much effort in the development of details and special handling fittings is required for satisfactory results The history of catapulting operations contains many instances of material casualties of varying importance from Langley's pioneer work to the latest examples Thus far, the history is singuarly free from serious casualties to personnel The occurrence of casualties in catapulting is so definitely out of the control of the plane's pilot that it is a particular responsiblity of those governing the design to require for this condition an especially careful check of structural strength

Technical Reviews

(Continued)

Report V175. The infuence of the ribs on the strength of the main plane spars* The ribs joining both main spars of an aeroplane wing bring about a repartition of the load by which the shearing force and bending movements actings on the spars may be greatly affected

The report gives theorethical calculations of the influence of the ribs. To simplify the problem the wing covering has been neglected.

Firstly, the formation of the differential equations is given These equations contain only the deformations of the spars as unknown quantities A simplification of the equations, important with regard to the solubility is obtained by assuming the ribs to be infinitely rigid For the most general case where the moments of inertia the distance between spars and the load are arbitrary functions of x, an approximate method of solution has been developed If the ratio between the moments of inertia is constant, another method may be applied For the simplest case of prismatical spars, constant distance between spars and uniform load the general solution is given.

A number of cases has been calculated, in which the moment of inertia of the spars from the centre of the wing to the tips varies

National Advisory Committee for Aeronautics, Technical Report No 291, by A F Zahm, R H Smith, and F A Louden—This report presents the results of wind tunnel tests on eight C-class airship hulls with various fineness ratios, conducted in the Navy Aerodynamic Laboratory, Washington, D. C The purpose of the tests was to determine the variation of resistance with fineness ratio, and also to find the pressure and friction elements of the total drag for the model having the least shape coefficient

Seven C-class airship hulls with fineness ratios of 1 0, 1 5, 2 0, 3 0, 6 0, 8 0, and 10 0 were made and verified These models and also the previously constructed original C-class hull, whose fineness ratio is 4 62, were then tested in the 8 x 8 ft tunnel for drag at 0 deg pitch and yaw at various wind speeds

This account is a slightly revised form of Report No 335, prepared in the Bureau of Construction and Repair for the Bureau of Aeronautics, May 14, 1927, and by it submitted for publication to the National Advisory Committee for Aeronautics

Society of Automotive Engineers, Paper on Aircraft Propellers, by Lieut Comdr Clinton H Havill, U. S. N.—Nearly all the aircraft propellers used by both the Army and the Navy are of the detachable blade type The Navy has found it necessary to make its own desigos and to furnish the propeller manufacturers with finisbed detail drawings The author lists the sources from which data can be obtained and shows a chart from which can be found a diameter and setting of a pair of detachable blades that will give reasonably good performance for nearly any horsepower, number of revolutions per minute and airspeed commonly used on direct drive propellers

Discrepancies between model tests and wind tunnel tests are cited and the author then considers the subject theoretically Substitute propellers are next considered, and also the strength of propellers The author gives empirical formulas for maximum fiber-stress and explanations of them, describes the whirl test for strength, discusses the necessity for the use of gearing, and enumerates the facts that apply to variable pitch propellers

Report A32 Experiments the action of the ailerons of a thick tapered wing* Rolling and yawing have been measured at angle of incidence ranging from —5 deg to +25 deg and angles of yaw β of 0 deg, 10 deg and 20 deg., so both normal and stalled flight and sideslipping are considered

The report is divided in the parts: Description of the model, Description of the method of testing, Reduction of test data, Results of the experiments with angle of yaw $\beta = 0$ deg, Results of the experiments with angle of yaw $\beta = 0$ deg, Conclusions, Appendices Appendix I gives a very complete summary of the existing literature III gives a theory of the tunnel-wall-inference

Report M219 Mechanical properties of some materials that are used for the construction of aeroplane* Generally speaking, the stresses that are tolerated in aeronautical constructions are higher than in other technical constructions Therefore it is necessary to determine carefully the highest stresses which may occur and also the actual properties of the material used Many tests were made on different steels, woods, light aluminum alloys and fabrics for coverings The results are shown in tables

* National Institute for Aeronautical Research Amsterdam, Holland